

The Perverse Impact of Calling for Energy Conservation

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Not for Publication - Online Appendix

This Appendix presents results related to additional pollutants beyond CO₂; additional results for highly congested hours; several additional robustness and specification tests; a sample media story; and sample utility press release.

1 Impact on Additional Pollutants

Estimates by fuel source in the main text indicate that oil and natural gas plants fuel the mid-day increase in energy usage on media days. (Table 5 of the main text.) If so, this carries additional implications for pollutants other than CO₂. Specifically, the mid-day impact of media days should be more muted for SO₂ than for CO₂ as natural gas plants do not emit SO₂. NO_x, on the other hand, should show an emission pattern more similar to the CO₂ results in the main text.

Estimates for γ_m in Equation 1 when the dependent variable is either SO₂ or NO_x are presented in Table 1 below. In line with expectations, there is little impact on SO₂ emissions over the heart of the day, although we do observe some reductions in the evening hours, which reflects the result that coal plants are being cycled down in these hours. (See Table 5 of the main text.) NO_x emission levels largely follow the pattern of CO₂.

Table 1: Impact on Other Pollutants

Hour	CO2	SO2	NOx
	(1)	(2)	(3)
1	-3.9	-32.0	23.3*
2	-4.7	-2.6	17.6
3	-4.6	66.5*	17.0
4	-2.0	99.7*	21.6**
5	-3.4	50.0	12.5
6	-3.9	1.4	6.1
7	-1.8	-6.9	8.4
8	2.3	10.0	16.3
9	5.8**	-11.3	18.4**
10	11.3***	-9.3	33.6***
11	9.8***	-24.6	53.8***
12	9.7***	-20.0	32.1**
13	8.9***	-8.7	32.7***
14	8.3**	-26.8	22.6
15	10.0***	-10.4	12.1
16	6.0*	-23.7	-19.5
17	4.9	-28.9	-21.1
18	3.1	-36.1	-23.5
19	-0.8	-97.5**	-27.4*
20	-0.5	-102.9*	-16.0
21	-0.3	-98.4*	-1.3
22	-2.3	-103.8*	8.3
23	-7.3*	-131.5**	-11.8
24	-9.3**	-145.0**	-21.0
N	1534655	1534655	1534655
Regional or Boiler level?	Boiler	Boiler	Boiler

Note: The asterisks represent statistical significance as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
Source: See main text.

2 Congestion Results

During congested hours the ability of PEPCO and BGE zones to import or export power from other nearby zones is severely limited. Focusing on these hours increases the probability that the observed generation response to media stories calling for conservation is driven by demand in the Baltimore-Washington DC metropolitan area.

Table 2 reports the results of the baseline specification on a sample restricted to include only congested hours. Columns 1-3 use the price difference between Western Hub (in Western Pennsylvania) and the PEPCO zone as a proxy for congestion. Columns 4-6 use the price difference between Allegheny Power Systems (APS) and PEPCO.¹ Columns 1 and 4 restrict the sample to only those hours in which the price difference between the pricing point and PEPCO is in the 50th percentile or greater of all observed price differences during the sample. Columns 2 and 5 further restrict the sample to hours above the 80th percentile and columns 3 and 6 restrict the sample to the 90th percentile price differences and greater.² Dashed lines indicate that there were no hours during press release days with media stories that exceeded the congestion cutoff.

The results are consistent with those reported in the main text. In every specification generation during the morning hours is significantly higher on media days. Generation over the peak hours is not statistically significantly different from zero, though in all of the specifications hour 23 is negative and occasionally statistically significant. The main result of the paper that media stories calling for conservation are associated with increases in demand is unchanged by restricting the sample to the most congested hours. This provides further suggestive evidence that the observed change in generation is driven by consumption in Baltimore-Washington area associated with exposure to conservation messaging.

¹Results using BGE zonal price instead of PEPCO are essentially unchanged and available upon request.

²Sample size differs across columns because thresholds are defined off the time series of prices, but estimation is on the full panel of boilers. Each hour potentially has a different number of boilers online.

Table 2: Baseline Specification Under Various Definitions of Congestion Hours

Pricing point	WH	WH	WH	APS	APS	APS
Congestion Threshold	50	80	90	50	80	90
	(1)	(2)	(3)	(4)	(5)	(6)
1	—	—	—	—	—	—
2	-3.0	—	—	-3.7	—	—
3	-3.0	4.6	—	-2.5	4.6	—
4	-0.2	7.7	—	-2.6	7.7	—
5	-1.4	9.2	—	-7.4	9.2	—
6	-0.4	8.3	—	-8.0	8.3	—
7	1.1	16.1**	—	-1.9	16.14**	—
8	5.1	25.5***	31.7***	7.2	25.46***	26.3***
9	8.2**	20.3***	10.9*	9.9**	20.33***	11.3*
10	17.8***	14.9	12.2**	15.7***	15.0	25.4**
11	14.2***	12.8**	18.3**	16.9***	12.81**	19.9**
12	10.1***	11.5**	8.4	17.2***	11.52**	0.9
13	8.6**	18.2***	7.7	20.1***	18.15***	15.1
14	7.5**	14.5**	9.0*	17.7***	14.52**	13.4
15	7.9**	16.6**	8.0*	16.6***	16.59**	14.3**
16	3.4	6.8	5.2	7.7*	6.8	7.2
17	1.7	3.1	1.3	5.4	3.1	2.3
18	0.2	5.2	3.2	4.6	5.2	5.2
19	-1.1	-0.4	-3.2	3.7	-0.4	0.4
20	-0.4	4.4	0.1	4.5	4.4	5.6
21	4.6	-5.7	-5.2	1.7	-5.7	-9.8
22	-0.2	-3.4	-8.1	0.07	-3.4	-1.3
23	-6.8	-11.9**	-15.7***	-7.5	-11.89**	-12.5
24	-9.7*	10.9*	7.0	-13.9*	10.94*	10.2
N	1337864	307835	160429	605628	246677	128911
Congestion Hours Only?	Yes	Yes	Yes	Yes	Yes	Yes
Zonal or Boiler Level?	Boiler	Boiler	Boiler	Boiler	Boiler	Boiler

Note: Congestion is measured as the price difference between Western Hub (WH) or Allegheny Power Systems (APS) and PEPCO. Congestion threshold is the minimum percentile price difference between the pricing point and PEPCO included in the sample. The asterisks represent statistical significance as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: See main text.

3 Robustness Checks

This section describes a variety of robustness checks conducted to test various hypotheses that could be consistent with the observed consumption pattern beyond consumer response to media conservation behavior.

The initial robustness test estimates the baseline specification on a sub-sample of the data where the daily high temperature exceeds the lowest high temperature on a press release day. July 14th, 2005 has the lowest high temperature of any press release day at 29.5 (approximately 85°F) so the control group in this specification includes all days with high temperature above that level. If our baseline results simply reflect the fact that media days have different underlying weather patterns (as proxied by temperature) and that the weather controls in the baseline specification are inadequate, limiting the sample in this way should ensure a more appropriate control group. The results, shown in the second column of Table 3, are consistent with the baseline specification. The July 14th, 2005 press release has a significantly lower temperature than the next lowest high temperature on a press release day, but the results are consistent when increasing the threshold to 32.2°C, the next lowest maximum daily temperature.

The results in the main text included boiler, day-of-week, and month-by-year fixed effects. We augment Equation 1 in the main text with a boiler-by-hour fixed effect (replacing the boiler fixed effect), and re-estimate Equation 1. The results, located in Column 3 of Table 3 indicate no remarkable change in the estimated impacts of media events.

Column 4 of Table 3 is restricted to the years 2006-2010. Increases in energy usage are larger over the midday hours, but the pattern of increases in morning generation followed by no significant change in afternoon generation remains unchanged. Finally we include omitted weather variables (atmospheric pressure, wind speed, relative humidity, and interaction of temperature and wind speed) to more closely mimic the PJM load forecasting model. Due to missing data the inclusion of these variables reduces the sample size by around eight percent. The results are robust to the

inclusion of these additional weather controls and estimates are similarly precise. The results in this table suggest the observed pattern of generation is robust to a variety of different samples and set of controls.

Table 3: Robustness Checks

Hour	Baseline	High Temp Days Only	Unit By Hour Fixed Effects	2006-2010	Include Atm. Pressure Wind Speed
	(1)	(2)	(3)	(4)	(5)
1	-1.9	-1.9	-1.1	-4.0	-1.4
2	-3.3	-3.2	-2.2	0.3	-3.4
3	-4.3	-4.2	-3.0	2.1	-4.2
4	-1.2	-1.0	-0.2	5.7	-0.4
5	-2.6	-2.4	-1.8	7.4	-1.7
6	-3.5	-3.4	-3.1	11.0	-3.5
7	-0.8	-1.4	-0.8	17.0*	0.4
8	4.2	3.7	5.1	23.9**	3.9
9	8.4***	8.0***	8.8***	25.8**	8.7***
10	16.8***	16.3***	16.8***	28.3***	13.2***
11	16.9***	16.3***	16.5***	24.1***	15.6***
12	14.3***	14.2***	13.6***	25.0***	14.1***
13	12.0***	11.4***	11.0***	19.7**	11.9***
14	10.5***	9.9***	10.1***	15.4*	8.3**
15	11.1**	10.6**	11.1**	8.2	12.9***
16	5.1	4.4	4.8	3.3	3.7
17	3.0	2.1	3.0	-1.6	2.0
18	1.0	-0.3	1.1	-2.6	3.0
19	-2.9	-3.6	-2.4	-1.0	-0.9
20	-2.1	-2.2	-2.5	-5.3	-2.6
21	-0.9	-1.6	-1.1	-4.3	-0.7
22	-2.5	-3.0	-2.0	-3.6	0.2
23	-8.3*	-7.6*	-7.2	-7.3	-8.2*
24	-10.9**	-10.0**	-9.4*	-9.7*	-10.8**
N	1534655	619371	1534655	673204	1415284
Congestion Hours Only?	No	No	No	No	No
Zonal or Boiler Level?	Boiler	Boiler	Boiler	Boiler	Boiler

Note: See text for specification details. The asterisks represent statistical significance as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: See text.

4 Example Media Story

August 10, 2001, Friday, BC cycle

Power companies say electricity reserves holding up under record demand

BYLINE: By JOHN BIEMER, Associated Press Writer

SECTION: State and Regional

LENGTH: 477 words

DATELINE: BALTIMORE

Customers cranking up the air conditioning to get relief from an oppressive heat wave have driven demand for power to record highs, but Maryland's top utility regulator said power reserves were holding up fine. "So far, I'm not aware of any particular problem except just high usage," Cathy Riley, chairwoman of the state Public Service Commission, said Friday.

Baltimore Gas and Electric Co., the state's largest utility, reported that its 1.1 million customers in central Maryland were using power at a record rate. On Thursday, BGE consumers used an all-time record 6,551 megawatts, breaking the record of 6,442 megawatts set the previous day. Records before this week had been set in 1999. Such demand prompted Mid-Atlantic power grid operator PJM Interconnection to impose a 5 percent voltage reduction for two hours Thursday afternoon on member utilities, including several in Maryland.

The voltage reduction, which was not detectable for most consumers, "typically is the last step before you go to rolling blackouts," said Charles Taylor, a spokesman for Potomac Electric Power Company, which has about 700,000 customers in Washington and Maryland. Taylor said there were a "handful of heat-related outages" in the Adams Morgan section of Washington, where a number of restaurants and other businesses were affected. Other major suppliers, such as Allegheny Energy Inc. and BGE, insisted they were never close to implementing blackouts. "Certainly not in this area," BGE spokeswoman Kathleen Nolan said. "I can't speak for other utilities. But that was not a concern here."

BGE and others on Friday again urged customers to conserve energy wherever possible, particularly during the late afternoon and early evening. Nolan said consumers were heeding those requests, although there was no way to quantify how much. Efforts to conserve energy were boosted by Gov. Parris Glendening, who ordered all state offices to raise thermostats to 80 degrees and eliminate unnecessary power usage. Taylor said it seemed many customers were consuming more energy as the hot weather dragged on. “Whenever you get into a heat wave, the first couple of days people can tolerate a little better, but as the week goes on day after day after day ... more people are seeking relief,” he said. But Jay Mason, a spokesman for Allegheny, which serves western Maryland, said there was a “significant slacking off” of demand Friday afternoon when a cold front began dropping temperatures.

Riley said it was too early to know whether the extraordinary stress placed on power companies this week indicates any long-term supply problems in Maryland. “Even when things appear to be fine, a plant can go down, things can happen,” she said. “This peak is higher than the one two years ago. It clearly indicates we need to add generating capacity.”

5 Example Press Release

Pepco Asks Customers to Conserve Electricity *Wednesday, July 07, 2010*

Heat Continues to Push Electricity Use Higher

WASHINGTON Pepco today requested the public to conserve electricity. The call for conservation was prompted by the intense heat wave.

The request is being made throughout Pepcos service territory. Demand for electricity is expected to increase as the excessive heat and humidity continue. The electric utility asks customers to conserve electricity, if health permits, especially between 3 p.m. and 7 p.m. Electricity customers can take simple conservation steps:

Close curtains and blinds to keep out the sun and retain cooler air inside. Postpone using

major electric household appliances such as stoves, dishwashers and clothes dryers until the cooler evening hours. If health permits, set air conditioner thermostats higher than usual. Turn off electric appliances and equipment that you do not need or are not using.

Conserving electricity will help ensure adequate power supplies. Pepco continues to carefully monitor power supply conditions. It will do everything possible to keep power flowing in the region. If necessary the utility may take additional steps, such as reducing voltage.