

The Perverse Impact of Calling for Energy Conservation

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Camp Resources
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Calls for Conservation

At times of high load utilities ask for help

Pepco Urges Customers to Conserve Energy

Pepco today urged customers to conserve energy wherever possible as high temperatures are forecasted to affect the entire mid-Atlantic region. While power supply in the region is expected to be sufficient to meet anticipated high demand, extreme heat also can stress electric system equipment. -July, 18 2011

Conservation and the electric grid

- Electric grid has fixed capacity in the short term
- Expansion is costly & network under-utilized during non-peak times
- Well known solution:
 - Shift demand from peak to non-peak
- Conservation goes from private to public good when network is congested

Effectiveness of Conservation Programs

There is considerable evidence that decentralized consumer conservation programs work

- Wolak (2011) finds dynamic pricing is associated with a 3-9% reduction in demand
- Alcott (2011) finds behavioral cues can reduce demand 2% at low cost
- Auffhammer *et al* (2008) finds evidence that utility managed conservation programs can save 1-2%

Research Question

What are the supply-side impacts of calls for conservation?

- How do consumers respond to calls for conservation?
- What are the energy market impacts?
- Is there an emissions impact of calls?

Data Set Description

- Assemble a panel of power plant, energy market and weather data
- Collect dates of utility requests for conservation
- Comb press release archives and area media from PEPCO and BGE

Build a data set of ≈ 1.5 million unit-hour observations for May-September for power plants 65 units at 16 power plants in Maryland between 2000-2010

Media Search

Search area media outlets for calls for conservation:

Washington Post	NPR
Daily Record (Baltimore)	Baltimore Business Journal
The Capital (Annapolis)	Washington Business Journal
Washington Times	WJLA (ABC)
AP	WTOP Radio
WBALTV.com (NBC Baltimore)	

- Text search of media outlets (conservation, electricity, energy, blackout, utility names)
- Compare conservation story dates to press release dates
- Media resources are fixed in the short term so press release exposure is a function of other 'news worthy' events

EPA CEMS Data

EPA is charged with implementing and monitoring SO₂ markets

EPA Constant Emissions Monitoring Systems measure:

- Operating status of the plant

- Power output

- Pollution emissions

- Abatement technology

Sampled every minute and aggregated to the hourly level

Audited and published by EPA to compare to permit holdings

Available hourly for most fossil fuel burning power plant from late 90's till today

Merged with hourly energy market data from PJM

Summary Statistics

Table : Summary Statistics

Variable	Full Sample	Media Days	PR Days
DA Price	53.81 (41.87)	118.09 (114.65)	132.33 (116.29)
RT Price	54.72 (53.92)	126.84 (154.99)	138.60 (160.79)
DA Load % Max	0.73 (0.13)	0.97 (0.03)	0.94 (0.07)
RT Load % Max	0.74 (0.13)	0.97 (0.03)	0.93 (0.08)
Temp	22.65 (5.68)	29.48 (4.27)	29.50 (4.73)

Empirical Strategy

Two identification strategies:

- Start with a fixed effects regression to exploit quasi-experimental variation

Month-Year

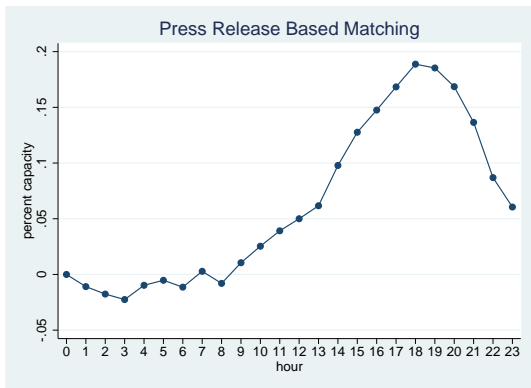
Day of week

Facility

- Matching estimator to pick control days

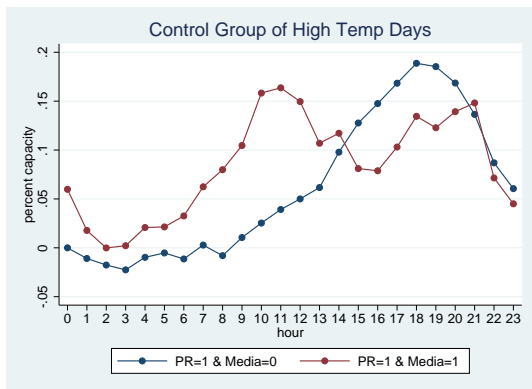
Compare days where press release is/not picked up by media

Press Release versus Media Coverage



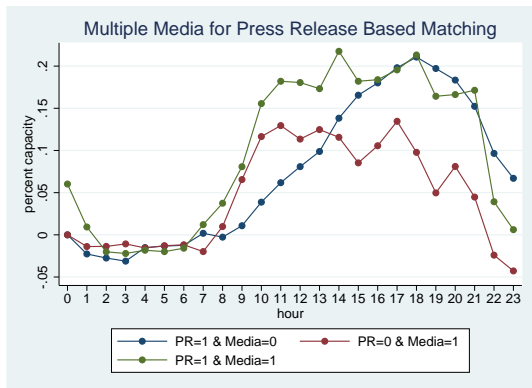
- 24 hourly coefficients for hour by media indicator by press release indicator
- Regression includes weather and energy market controls
- Standard errors clustered at unit level

Press Release versus Media Coverage



- Not all press releases are picked up in media and not all media coverage is based on press release
- 28 press releases, 21 media events, 10 days of overlap
- Media coverage seems to shift generation to morning hours

Multiple Media Outlets



- As treatment intensifies peaks increase
- Timing of peak does not change
- Increased exposure to media message associated with higher peaks

Day Matching Procedure

- First stage logit to estimate the probability of a press release calling for conservation
- Use day ahead load and pricing estimates
- Ideally use weather forecast, but that is not available for the full time series

$$\text{PressRelease}_t = W_t + W_{t-1} + W_{t-2} + \text{DA Load}_i t + \text{DA Price}_i t + \psi + \eta,$$

where DA Load is a vector of regional load forecasts and DA Price is a vector of 17 prices for production at MD generators

Use predicted values from this regression to match most similar media/non-media days

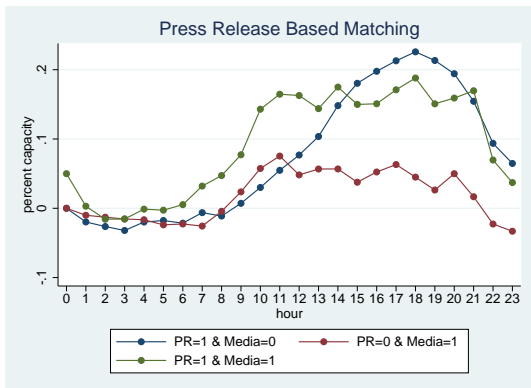
Introduction day-pair fixed effects to previous regression

Probit Results

Dep Var	Press Release	Cycling
Temp	-1.886* (-1.84)	-0.189 (-1.19)
Humid	1.849** (1.99)	0.030 (0.40)
Liquid Precip	-0.589** (0.48)	
Max DA Load	7.399*** (3.25)	
Max RT Load		14.387 (1.29)
N	1,986	1,986
Pseudo-R2	0.80	0.57

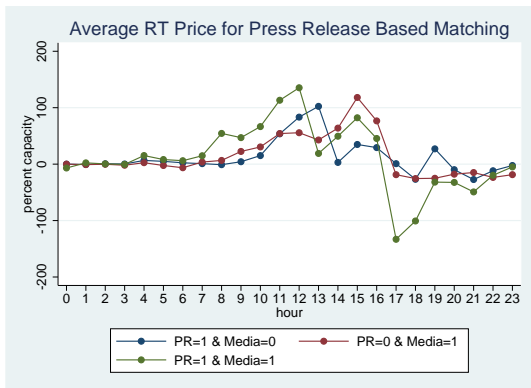
- Selected results from probit specification
- Produce fitted values from this specification

Press Release versus Media Coverage



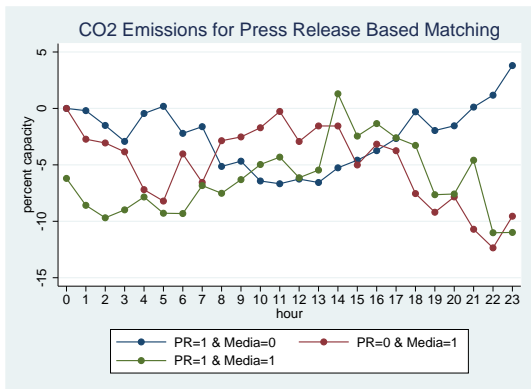
- Results are extremely similar to 'date-based' identification strategy

Energy Market Impacts



- Media has an impact on market pricing
- Average pricing difference of \$1,500/MW when media picks up press release
- Generation around 97MW higher
- Partial equil calculation suggests market cost of \$1.3 million

Unpriced External Impact



- Media also has an impact on CO2 emissions
- Total emissions reduction of 264 tons
- Priced at \$25 per ton produces external costs of \$588,000

Robustness Checks

- ▶ Matching on media days
- ▶ High temperature control group
- ▶ Consecutive Press Releases
- ▶ Pre (2008) recession
- Results by fuel type: ▶ Natural Gas ▶ Coal

Conclusion: Perverse Impacts

Perverse Impact

- Media calls for conservation associated with increased demand
- Calls shift consumption through day with no (significant) conservation benefits
- Increased exposure to message associated with increased consumption
- Significant market distortions
- Possible non-market damages associated with fuel switching

Environmental Implications

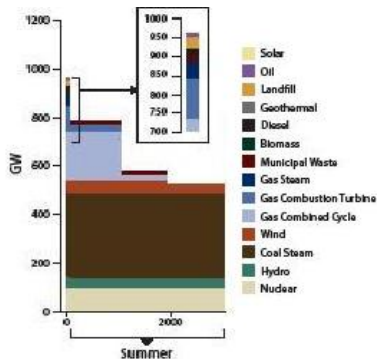
Fuels are heterogenous in pollution intensity

Dynamic pricing (and other load shifting) may have a negative impact on emissions

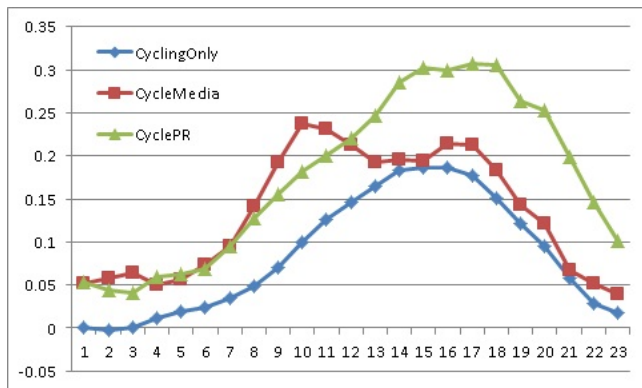
Table : Pounds of CO₂ per kWh

Fuel	Output Rate
Coal	2.1
Oil	1.9
Gas	1.3
Other	1.4

Figure : Gen Stack



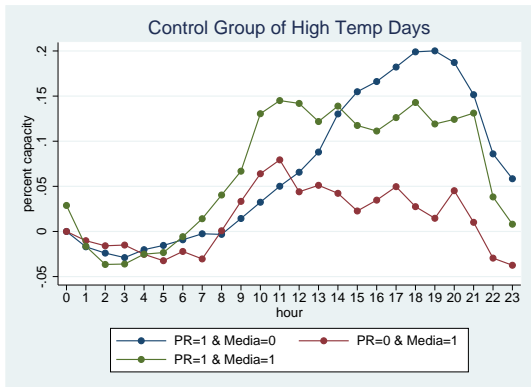
Media Day Matching



First stage probit based on media days (as opposed to press release days)

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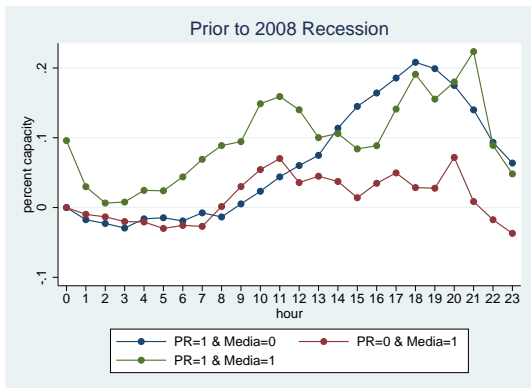
High Temperature Group



All control days have max temp above lowest press release day

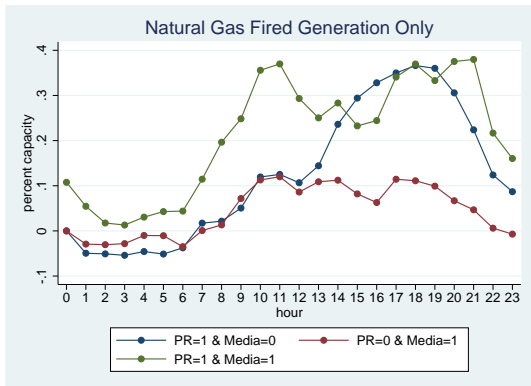
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Pre Recession Results



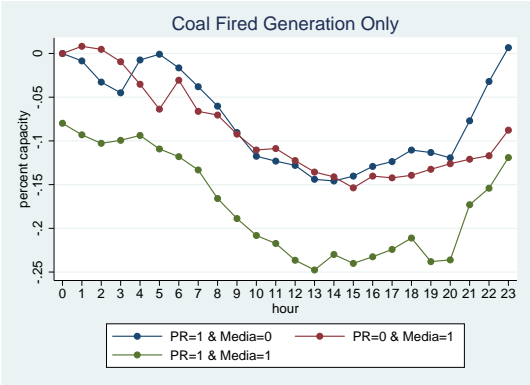
Press releases are (slightly under represented in later years of the panel. The results report a 2000-2007 sample. [▶ Back](#)

Natural Gas Results



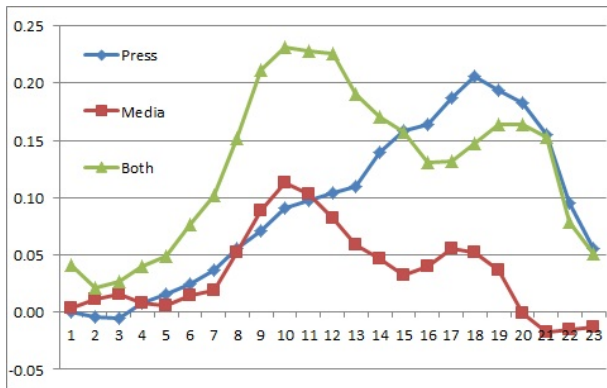
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Coal Results



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Single Event Press Releases



Note: Measuring the response of generators (measured as a percent of capacity) on days if the event was a single day (there was no press release the previous day).

Maryland Transmission System

