Designing policies to make energy systems greener

Soren T. Anderson
Associate Professor of Economics
Michigan State University

Many ways to reduce carbon emissions

- **Use less energy overall**
  - Drive fewer miles
  - Smaller, less-powerful cars
  - Energy-saving technologies (e.g., hybrids)
- **Switch to lower-carbon fuels**
  - Biofuels
  - Electricity (assuming low-carbon supply)

Economists *overwhelmingly* favor carbon pricing—taxes or cap-and-trade

- Rewards ALL behaviors that reduce emissions
- Gets the balance exactly right—allows firms and consumers to choose what's best for them
- Extensive empirical evidence shows that people respond as predicted to higher fuel prices

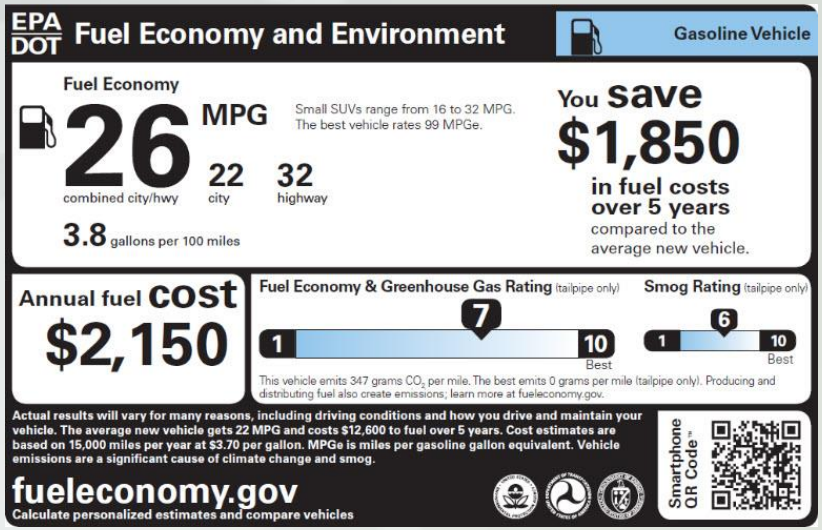
Other policies are more costly

Simulated Cost of a 9% Reduction in GhG Emissions from the U.S. Personal Transportation Sector During 2015-2040

	Total private cost ($/tCO2)	Cost with co-benefits ($/tCO2)
Current Policy Mix	49.9	33.7
Carbon Tax	16.5	-23.7
Fuel Tax	16.7	-23.9
Low-Carbon Fuel Standard	27.3	25.3
Renewable Fuel Standard	32.5	36.5
Fuel-Economy Standard	21.2	29.0
Size-Based Fuel-Economy Standard	28.3	77.6

Source: Anderson, Fischer, and Egorenkov, "Overlapping Strategies for Reducing Carbon Emissions from the Personal Transportation Sector," Working Paper, March 2016.

Information on energy costs is crucial

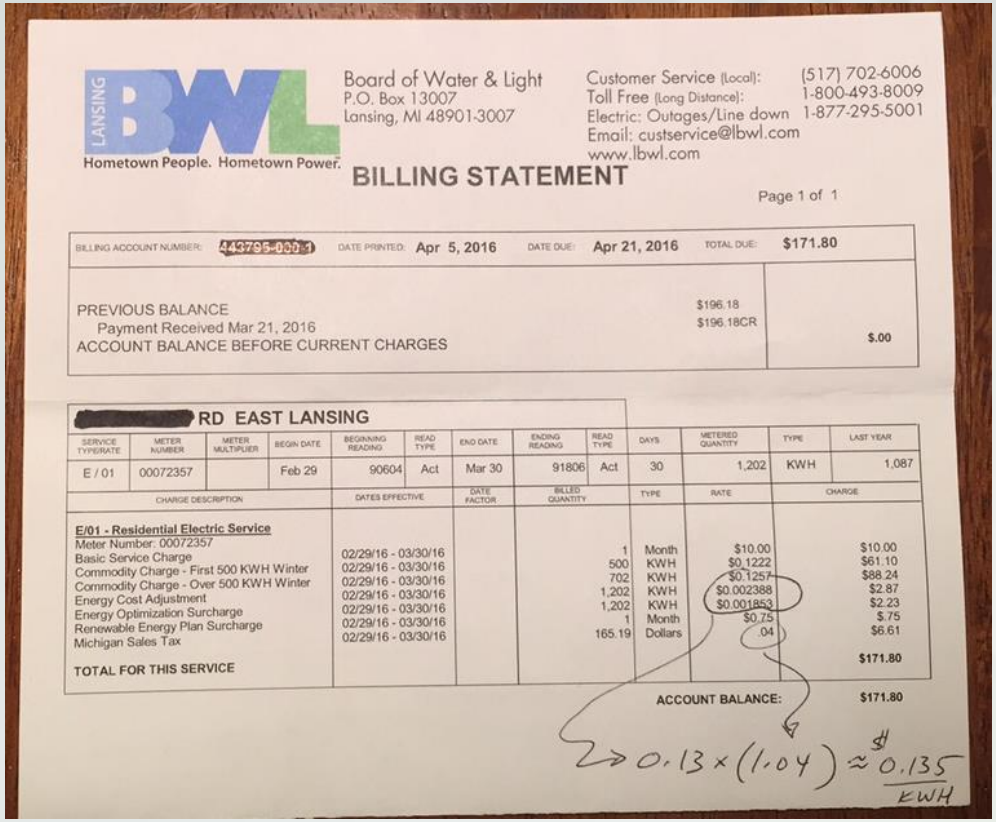


$3.70/gallon x 1/26 gallons/mile = $0.142/mile
x 15,000 miles/year ≈ $2,150/year

Thoughts on Michigan's energy policy

- Clean Power Plan implementation
  - Mass- vs. ratio-based, cost-minimization issues
- Make retail energy pricing more transparent
- Engage consumer behavior (e.g., via RTP) to reduce system costs and increase reliability
- Rigorous evaluation of efficiency programs

Q: What is the cost of operating your TV, washer, dryer, fridge, water heater, etc …?



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BILLING STATEMENT

Page 1 of 1

BILLING ACCOUNT NUMBER: [redacted] DATE PRINTED: Apr 5, 2016 DATE DUE: Apr 21, 2016 TOTAL DUE: $171.80

PREVIOUS BALANCE	$196.18	
Payment Received Mar 21, 2016	$196.18CR	
ACCOUNT BALANCE BEFORE CURRENT CHARGES		$.00

[redacted] RD EAST LANSING

SERVICE TYPE/RATE	METER NUMBER	METER MULTIPLIER	BEGIN DATE	BEGINNING READING	READ TYPE	END DATE	ENDING READING	READ TYPE	DAYS	METERED QUANTITY	TYPE	LAST YEAR
E / 01	00072357		Feb 29	90604	Act	Mar 30	91806	Act	30	1,202	KWH	1,087

CHARGE DESCRIPTION	DATES EFFECTIVE	DATE FACTOR	BILLED QUANTITY	TYPE	RATE	CHARGE
E/01 - Residential Electric Service						
Meter Number: 00072357						
Basic Service Charge	02/29/16 - 03/30/16		1	Month	$10.00	$10.00
Commodity Charge - First 500 KWH Winter	02/29/16 - 03/30/16		500	KWH	$0.1222	$61.10
Commodity Charge - Over 500 KWH Winter	02/29/16 - 03/30/16		702	KWH	$0.1257	$88.24
Energy Cost Adjustment	02/29/16 - 03/30/16		1,202	KWH	$0.002388	$2.87
Energy Optimization Surcharge	02/29/16 - 03/30/16		1,202	KWH	$0.001853	$2.23
Renewable Energy Plan Surcharge	02/29/16 - 03/30/16		1	Month	$0.75	$.75
Michigan Sales Tax	02/29/16 - 03/30/16		165.19	Dollars	.04	$6.61
TOTAL FOR THIS SERVICE						$171.80

ACCOUNT BALANCE: $171.80

$\rightarrow 0.13 \times (1.04) \approx \frac{\$}{KWH} 0.135$

1. What's your marginal price of electricity?
2. How much energy do your appliances use?

High-tech and low-tech options to make prices more transparent?

Higher prices + information = conservation

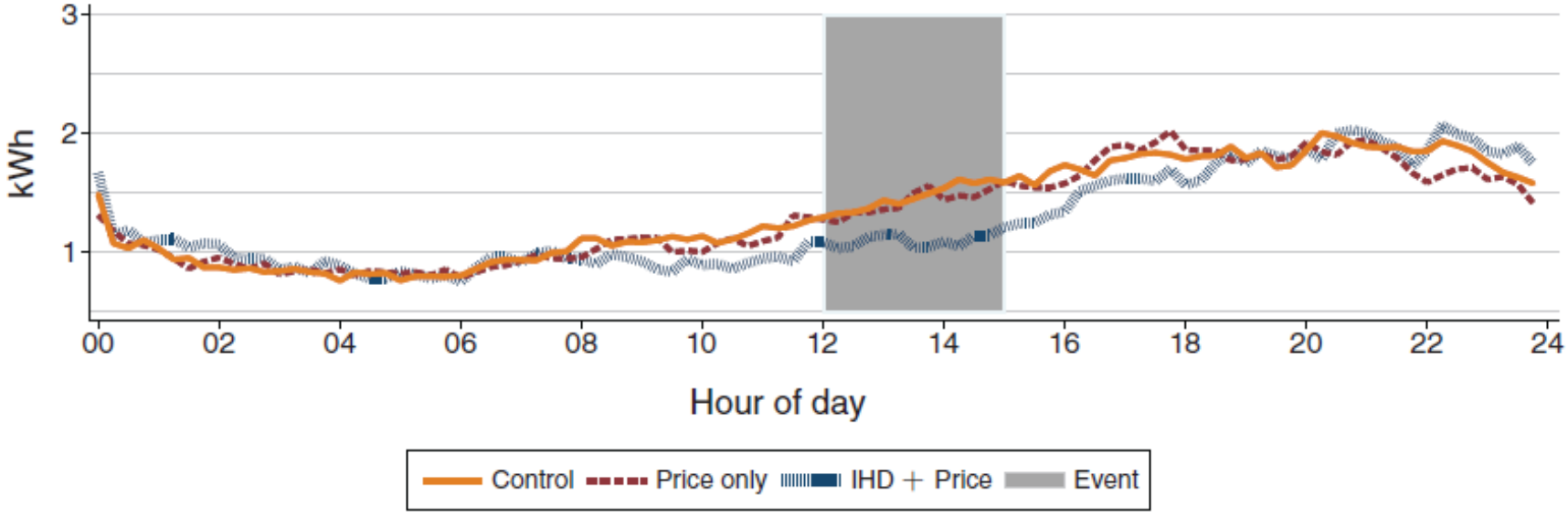

FIGURE 6. AUGUST 26, 2011: 4HR $0.50 INCREASE, DAY-AHEAD NOTICE

Source: Jessoe and Rapson, "Knowledge is (Less) Power: Experimental Evidence from Residential Energy Use," American Economic Review, Volume 104 (4): 1417-1438, April 2014.

Conclusions

- Carbon pricing leads to lowest-cost abatement
- Engage consumer behavioral response
- Support empirical economic research
  - Dollars
  - Data sharing
  - Research partnerships (e.g., program evaluation)