

# 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

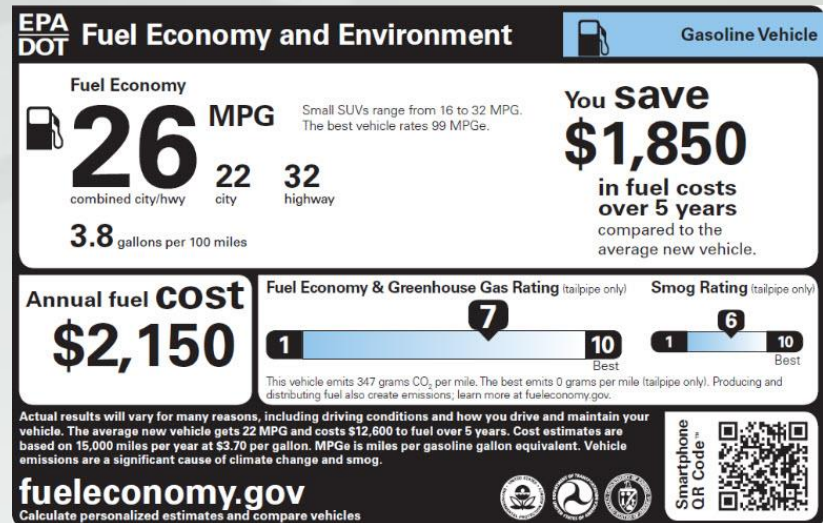
# Other policies are more costly

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

	Total private cost (\$/tCO <sub>2</sub> )	Cost with co-benefits (\$/tCO <sub>2</sub> )
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



$$\begin{aligned} & \$3.70/\text{gallon} \times 1/26 \text{ gallons/mile} = \$0.142/\text{mile} \\ & \times 15,000 \text{ miles/year} \approx \$2,150/\text{year} \end{aligned}$$

# 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 ...?

**BWL** Board of Water & Light  
Hometown People. Hometown Power.

Customer Service (Local): (517) 702-6006  
Toll Free (Long Distance): 1-800-493-8009  
Electric: Outages/Line down 1-877-295-5001  
Email: custservice@lbwl.com  
www.lbwl.com

## BILLING STATEMENT

Page 1 of 1

BILLING ACCOUNT NUMBER: **449795-0001** 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		\$0.00

**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
<b>E/01 - Residential Electric Service</b>						
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	\$0.75
Michigan Sales Tax	02/29/16 - 03/30/16		165.19	Dollars		\$6.61
<b>TOTAL FOR THIS SERVICE</b>						<b>\$171.80</b>

ACCOUNT BALANCE: \$171.80

*Handwritten note:*  $2 \rightarrow 0.13 \times (1.04) \approx 0.135$   $\frac{\$}{\text{KWH}}$

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

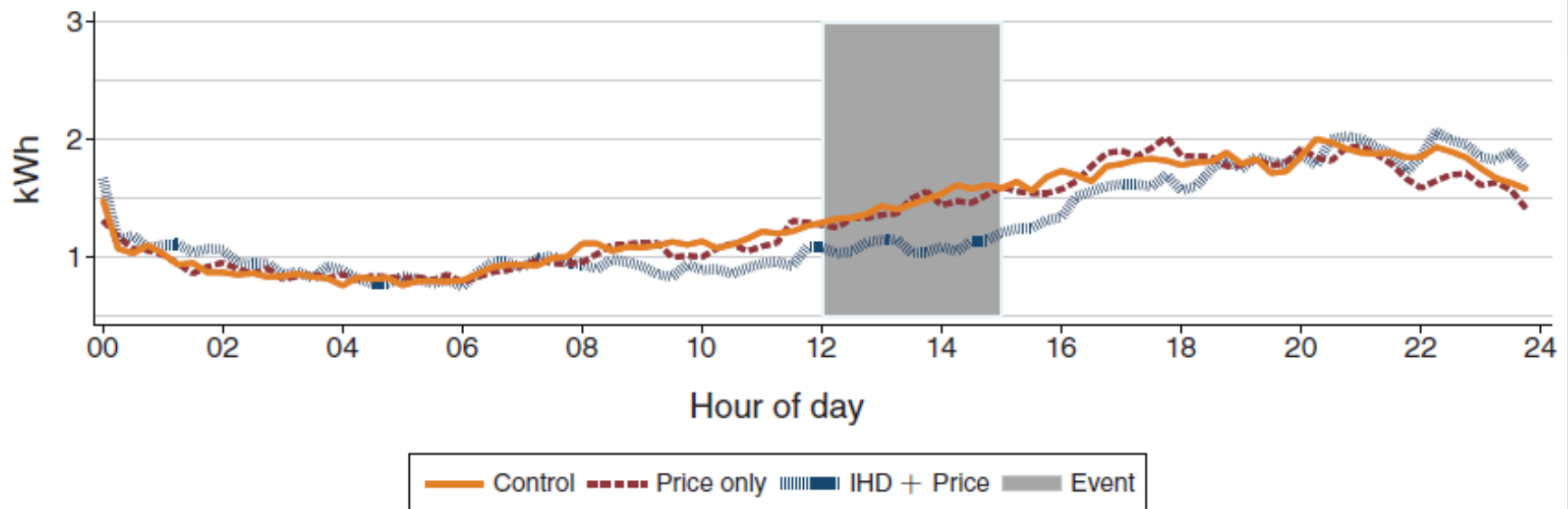


FIGURE 6. AUGUST 26, 2011: 4HR \$0.50 INCREASE, DAY-AHEAD NOTICE

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)