Behavior Wedge Profiles for Cities:
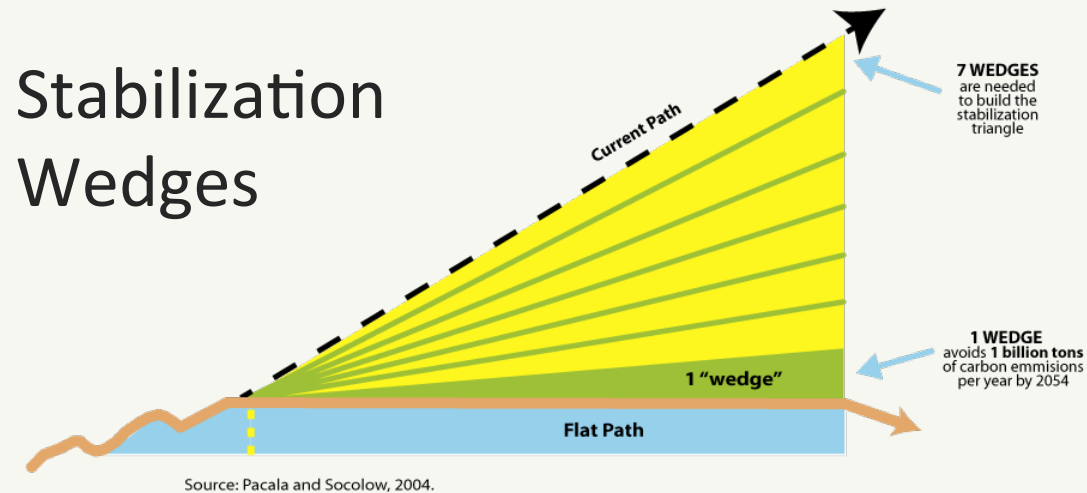## A New Tool for Identifying Opportunities and Targeting Behavioral Programs

Stabilization Wedges

Source: Pacala and Socolow, 2004.

7 WEDGES are needed to build the stabilization triangle

1 WEDGE avoids **1 billion tons** of carbon emmisions per year by 2054

Current Path

1 "wedge"

Flat Path

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Contents

1. Quick Overview of National Studies

2. Findings from the Prototype Model

3. Synopsis of the Methodology

Acknowledgements

Contributors:

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National Behavior Wedge Research

	Dietz et al. (2009)	Laitner & Ehrhardt-Martinez (2009)	Gardner & Stern (2008)
Focus:	Carbon Emissions Savings	Energy Savings Opportunities	Energy Savings Opportunities
Scope:	17 Household Actions	110 HH Actions (Roughly)	27 HH Actions (Roughly)
Potential Savings: Residential Sector	20% (of HH Direct Emissions)	22%	30%
Potential Savings: National	7.4% (of National Emissions)	9%	11%
Period to Achieve Max. Annual Savings	10 years	5 to 8 years	N/A

Conservative estimates for Residential and Personal Transport only.

Savings by Behavior Type

	Action Type	Estimated Savings (% of sector emissions)
Invest.	Buy a more fuel efficient vehicle	13.5%
Low cost	Install and upgrade attic insulation and ventilation	Up to 7%
Beh.	Car pool to work with one other person	4.2%
Beh.	Replace 85% of all incandescent bulbs with cfls	4.0%
Beh.	Get frequent tune ups and air filter changes	3.9%
Beh.	Turn HH temperature down (heating) or up (cooling)	3.4%
Beh.	Alter driving practices (no jack rabbit starts, etc)	3.2%
Invest.	Install more efficient heating unit	2.9%
Invest.	Replace poor windows with high efficiency windows	2.8%
Beh.	Combine trips to ½ current mileage	2.7%
Beh.	Cut highway speed from 70 to 60 mph	2.4%
Invest.	Install more efficient AC unit	2.2%
	13 Other Actions	6.6%
	TOTAL potential savings (unadjusted)	58.8%
	TOTAL potential carbon savings (adjusted for HH eligibility and double counting of savings)	30%

Source: adapted from Gardner and Stern (2008)
27 Actions Reviewed

Behavioral Approach

Benefits:

❖ Large Savings Opportunities
❖ Relatively Inexpensive
❖ Relatively Fast Change

Questions:

❖ How to Create the Change?
❖ Where to Focus the Efforts?

Problem/Need:

❖ National-level studies aren't helpful.
❖ City-level Information about Behavioral Opportunities is needed.

Can We Create **City-level** Wedges?

Cities have suggested that a BWP could help them:

1. Document the scale of behavioral opportunities,

2. Identify specific behaviors with the most promise of resource savings for a particular city,

3. Evaluate the relative importance of behavioral initiatives as part of a larger, city-wide sustainability, climate, and/or energy initiative,

4. Write more effective funding proposals,

5. Make the case for pursuing behavior-based opportunities with team members, supervisors, partner organizations, city councils, and others,

City-level Behavior Wedge Profiles:
Three Core Elements.

1. A low-cost approach:

2. A focus on **achievable**

   savings opportunities:

- (Eligibility) **x** (Likelihood of Participation) **x** (Range of Savings)

3. Targeting
   behavioral
   solutions:

Line-Drying
Versus
Dryer

The **Sample** Behavior Wedge Profile:
Residential Energy Sector – Baltimore, Maryland

Core Profile Components:

- Summary/Overview

- Top Ten Lists

- Opportunities by End-Use

The Sample Behavior Wedge Profile:
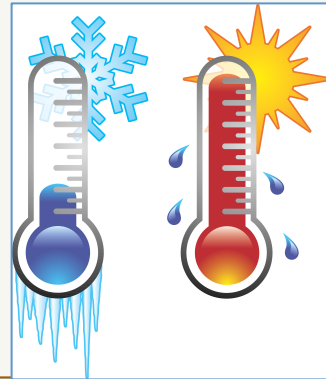## Residential Energy Sector – Baltimore, Maryland

Overview of behavior-related energy savings opportunities
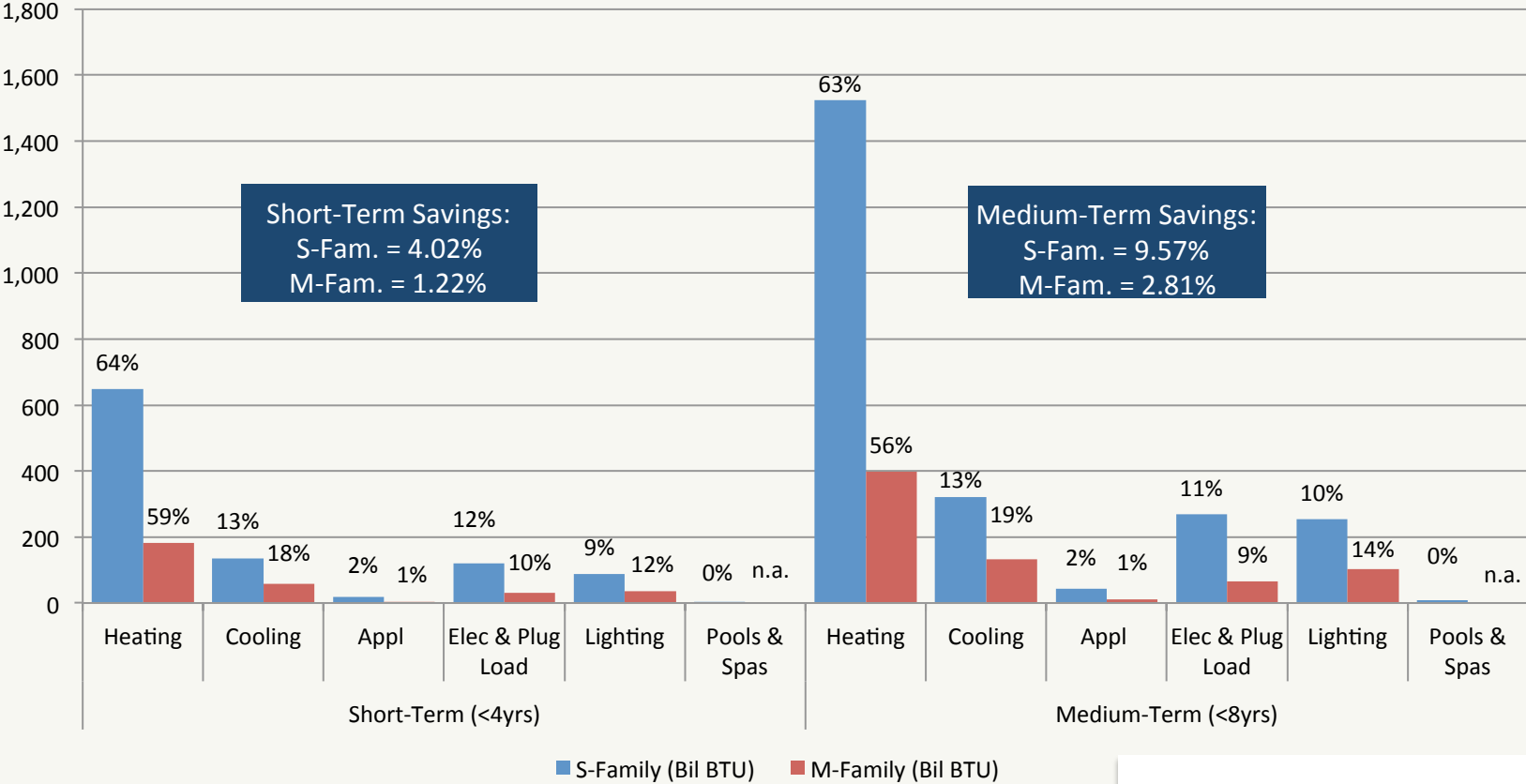
The Sample Behavior Wedge Profile:
Residential Energy Sector – Baltimore, Maryland

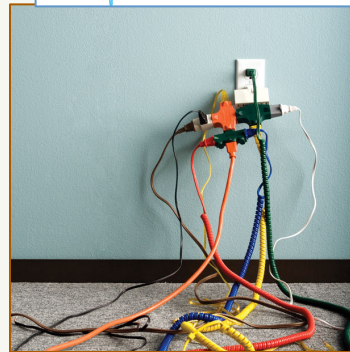**End-Use Categories and Target Behaviors**

Heating and Cooling

Appliances
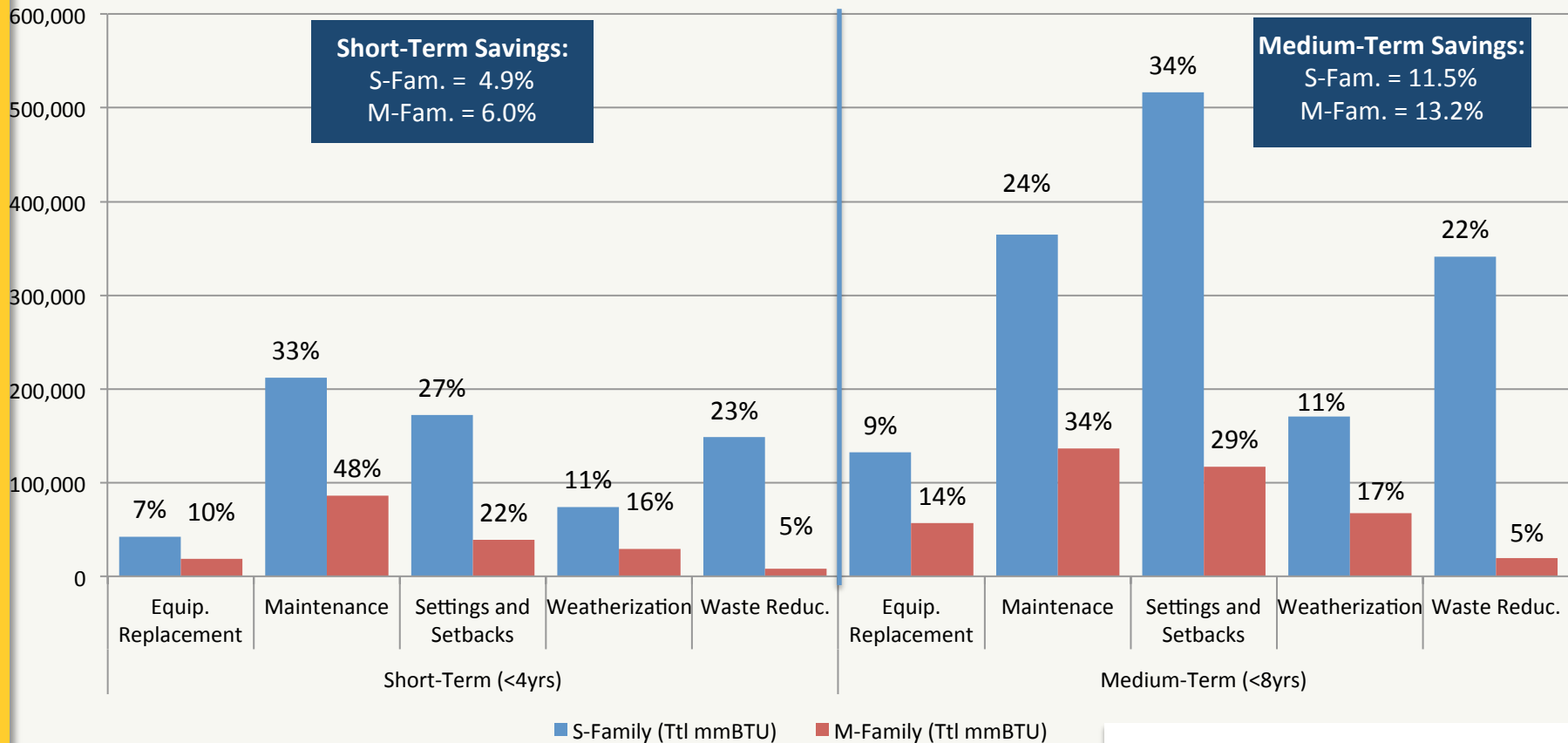
Plug Load & Electronics

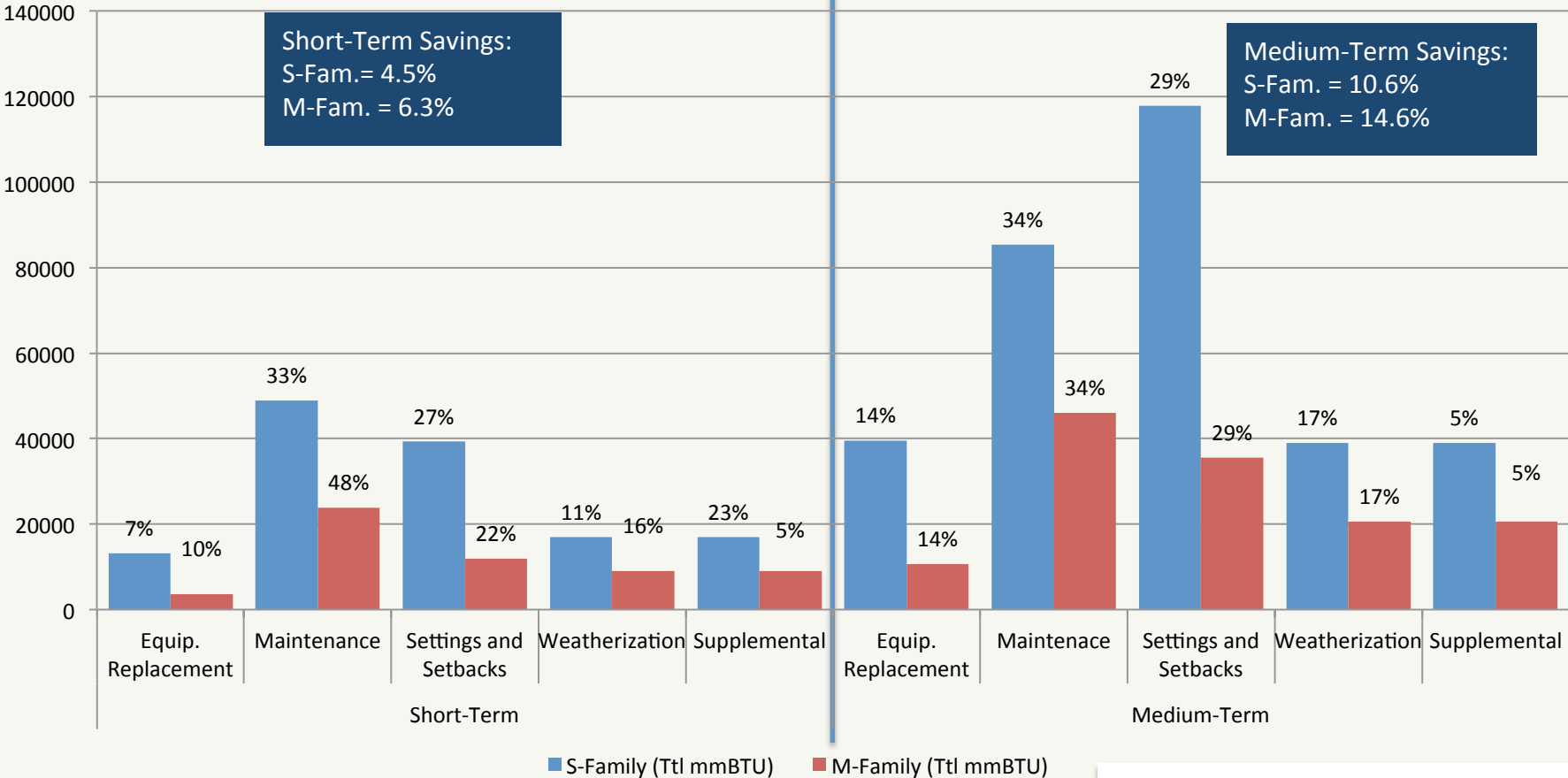Lighting (Pools And Spas)

The Sample Behavior Wedge Profile:
Residential Energy Sector – Baltimore, Maryland

Achievable Savings from Heating-Related Practices

The Sample Behavior Wedge Profile:
Residential Energy Sector – Baltimore, Maryland

Cooling-Related Energy Savings Opportunities

The Sample Behavior Wedge Profile:
Residential Energy Sector – Baltimore, Maryland

Top Ten Strategies for Reducing Energy Consumption in *Single Family* Homes

		Savings
1	Heating & Cooling: Setbacks and programmable thermostats	3.20%
2	Heating: Furnace maintenance	1.84%
3	Heating: Reduce wasteful heating practices	1.72%
4	Plug load: Plug Load management	1.09%
5	Heating & Cooling: Weatherization	1.06%
6	Lighting: CFL bulb replacement	0.89%
7	Heating: Accelerated furnace replacement	0.67%
8	Cooling: AC maintenance	0.43%
9	Electronics: Accelerated replacement of desktops with laptops	0.26%
10	Cooling: Alternative technologies and reductions in solar heat gain	0.20%
	Total Achievable Savings	11.36%

Behavior Wedge Assessment Methodology

Five Steps

- Identify data sources and Develop algorithms
- Extract necessary data
- Recode and normalize data as needed
- Weight using census data
- Apply algorithms to develop estimates

Behavior Wedge Assessment Methodology

Primary Data Sources

- The Energy Information Agency's Residential Energy Consumption Survey (**RECS**) and U.S. Census data

4 Sets of Algorithms across 23 Behaviors

cooling conservation actions	((# of SF homes) x (% of homes with central AC) x (% of homes in which bedrooms > HH occupants) x (short-term participation rate)) x ((avg. BTUs for AC per HH) x (est. % savings per HH))

Example is for short-term savings for cooling conservation action in SF homes only.

Closing Points

Sum: Behavior Wedge Profiles provide a low cost means of generating city-level estimates that reflect local conditions and practices.

Next steps: Residential and Commercial for 5 cities.

Future: Looking for funding and collaborators to extend the model to transportation and beyond and for other cities/states who are interested in getting a profile.

The Full Paper & Contact Information

The Full Paper

This presentation is based on a paper prepared for the 2013 BECC Conference. The full citation appears below.

Ehrhardt-Martinez, Karen. 2013. "Behavior Wedge Profiles for Cities: A New Tool for Identifying Opportunities and Targeting Behavioral Programs."

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