

Household Energy Use & Travel: Opportunities for Behavioral Change

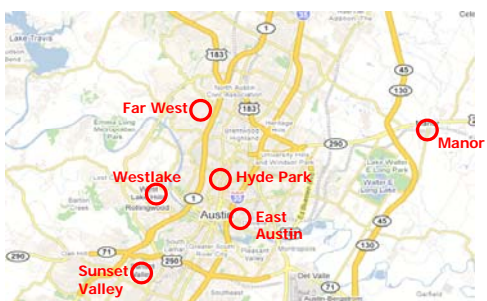
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Questionnaire Design

- Cover letter (English & Spanish)
- Five sections
 - Travel Choices
 - Vehicle Ownership
 - Home Design & Energy Use
 - Energy Policy Opinions
 - Demographics

Survey Distribution



Survey Distribution (2)

- Central Market Grocery
- Flyers & URL cards
- Community organizations
- Web links via CapMetro & City sites
- Internet version of the survey:
www.energysurvey.co.nr

Data Weighting

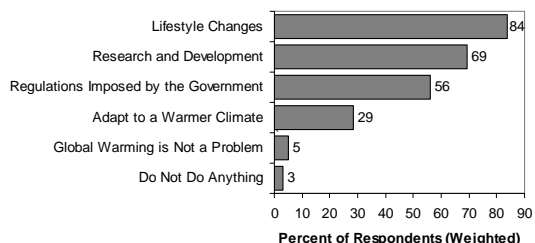
- Sample was compared to PUMS
- Six control attributes: 720 categories
 - Gender (male, female)
 - Student status (student, non-student)
 - Worker status (worker, non-worker)
 - Age (18-24, 25-34, 35-44, 45-54, 55-64, 65+)
 - Household Size (1, 2, 3, 4, 5+)
 - Income (<\$30k, \$30k-\$75k, >\$75k)
- Categories with few observations combined

Sample vs. Austin

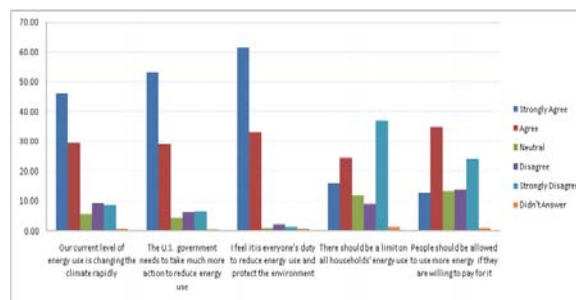
- **Workers** are under-represented (nearly 2 to 1).
- **Students** are very over-represented.

Variable	Sample	Austin
Female	49.6%	50.4%
Age 45+	37.5%	38.7%
High-income	46.6%	39.5%
Employed	37%	70.3%
Students	82%	13%

What Should We Do?



Where Do We Stand?



Yearly VMT per Person (WLS)

Variable	Coefficient	T-statistic	Mean Elasticity
Constant	5903	5.30	-
College-educated	-1437	-2.67	-0.135
Income per person	0.0203	1.77	0.099
Number of children	-1385	-5.48	-0.071
Distance to CBD	307.4	6.06	0.225
Population density	124.6	1.71	0.069
Population density & distance to CBD >6	-209.49	-1.68	-0.023
Transit stops	-16.34	-2.18	-0.054
Age of respondent	25.46	1.46	0.127
R ²		0.1289	
Adjusted R ²		0.1191	

Home Size & Monthly kWh (WLS)

Independent Variables	SQUARE FOOTAGE			MONTHLY ELECTRICITY		
	Coefficient	T-statistic	Mean Elasticity	Coefficient	T-statistic	Mean Elasticity
Constant	1006	8.28	-	701.9	4.15	-
Household size	44.16	1.55	0.0669	77.30	2.95	0.111
Worker status	143.1	1.80	0.0316	-	-	-
Income (\$1,000)	3.9 E-03	6.39	0.190	1.16 E-03	1.13	0.0540
College-educated	-221.8	-3.72	-0.097	-	-	-
Age of home	-9.09	-5.77	-0.175	2.70	1.05	0.0491
Own home	424.5	5.41	0.165	-186.7	-1.42	-0.0688
Number of vehicles	222.7	5.28	0.195	-	-	-
Number of adults	65.15	1.98	0.0849	-	-	-
Job density	-1.718	-1.83	-0.0077	-	-	-
Population density	-21.19	-2.94	-0.0544	-25.05	-0.98	-0.0608
Two- & three-story detached home	-	-	-	355.2	3.26	0.05
Home size	-	-	-	0.4918	6.46	0.469
R ²		0.3646			0.1958	
Adjusted R ²		0.3542			0.1844	

Home Size & Monthly kWh (WLS)

- Both increase as...
 - **Income** increases
 - **Household size** increases
- Both decrease as...
 - The area grows **denser**
- **Older homes** tend to be smaller but use more electricity.
- **College graduates** tend to have smaller home sizes.

Comparison to EIA's RECS Data

Comparison	Austin Energy Survey	RECS, 2001
Average home size	1,645 sq.ft.	2,100 sq.ft.
Average monthly kWh	1,200 kWh	900 kWh
+1 household member	+ 77 kWh	+ 104 kWh
+100 square feet	+ 49 kWh	+ 22 kWh

Opinions on Climate Change (Binary Probit)

Explanatory Variables	REGULATIONS SHOULD BE IMPOSED		ADAPT TO A WARMER CLIMATE	
	Coefficient	T-statistic	Coefficient	T-statistic
Number of household vehicles	-0.1136	-1.73	0.2571	4.04
Age of respondent	-0.0189	-5.20	-	-
Female	0.3192	3.54	-0.4526	-4.76
Worker status	-0.3136	-2.36	0.3405	3.03
Middle income indicator (between \$80,000 & \$112,500)	0.3267	2.83	-	-
College-educated	-	-	0.2217	2.13
Own home	0.1542	1.26	-	-
Rooms in home	-0.0729	-3.44	-	-
Age of home	0.076	3.20	0.099	4.03
Average annual VMT	-	-	-1.80 E-05	-3.18
Constant	1.0321	4.65	-1.1067	-6.03
Log Likelihood at Convergence	-540.37		-473.94	
Pseudo R ²	0.07251		0.07410	

Opinions on Climate Change (Binary Probit)

- Regulations preferred by...
 - **Women**
 - **Homeowners**
- Adaptation preferred by...
 - **Workers**
 - Households with many **vehicles**
- Those with **older homes** acknowledge the importance of both regulations & adaptation.

Energy Reduction Strategies (Bivariate Ordered Probit)

Explanatory Variables	CAP ON ENERGY USE		TAX ALL ENERGY USE	
	Coefficient	T-statistic	Coefficient	T-statistic
Number of household vehicles	0.1273	1.45	-0.2350	-2.74
Age of respondent	0.0211	3.85	-	-
Female	-0.1196	-1.03	0.2230	1.86
Number of workers	-0.1495	-2.27	-	-
College-educated	-	-	0.2496	1.92
Income per household member	-	-	-4.02 E-06	-1.51
Household size	-	-	0.05829	1.89
Worker status	0.4082	2.69	-	-
VMT per household member	-1.19 E-05	-1.40	2.9 E-05	2.96
Age of home	-0.076	-2.43	-0.048	-1.76
Rooms in home	0.0855	2.56	-	-
Own home	-0.1745	-1.21	0.1642	1.10
Threshold 1	-0.2276	-0.841	-1.4378	-6.32
Threshold 2	0.9332	3.55	-0.1253	-0.552
Threshold 3	1.385	5.14	0.4149	1.89
Threshold 4	2.104	7.84	1.209	5.42
Log Likelihood at Convergence	-2079.4015			
Covariance across equations' residuals	0.2124	3.37	-	-

Energy Reduction Strategies

- **CAPPING** is more popular with...
 - Households with many **vehicles**
 - **Older** respondents
 - **Workers**
- **TAXATION** is more popular with...
 - **College graduates**
 - **Large households**
 - **Homeowners**

Conclusions

- **Long-term behavioral changes** are difficult to implement.
- Most agree climate change is a concern, but are **unwilling to change their own behavior**.
- Increasing **income & education** lead to greater (stated) concern about one's impact on the environment.

Conclusions (2)

- **Electricity usage** tends to rise by 77 kWh/mo. per added household member & by 49 kWh/month for an added 100 sq.ft. in living space.
- **Electricity consumption** can be reduced by moving into newer, smaller homes.
- Annual **fuel consumption** tends to rise by about 16.6 gallon/person for every mile increase in driving distance to the CBD.
- Annual **VMT per person** estimated to increase by 307 miles with every additional mile a household lives away from the CBD.

Thank You
for your attention!

Questions & Suggestions?