



An Integrated Model System of Household Transport and Residential Energy Consumption

Shivam Sharda, Irfan Batur, Sara Khoeini, Taehooie Kim and Ram M. Pendyala

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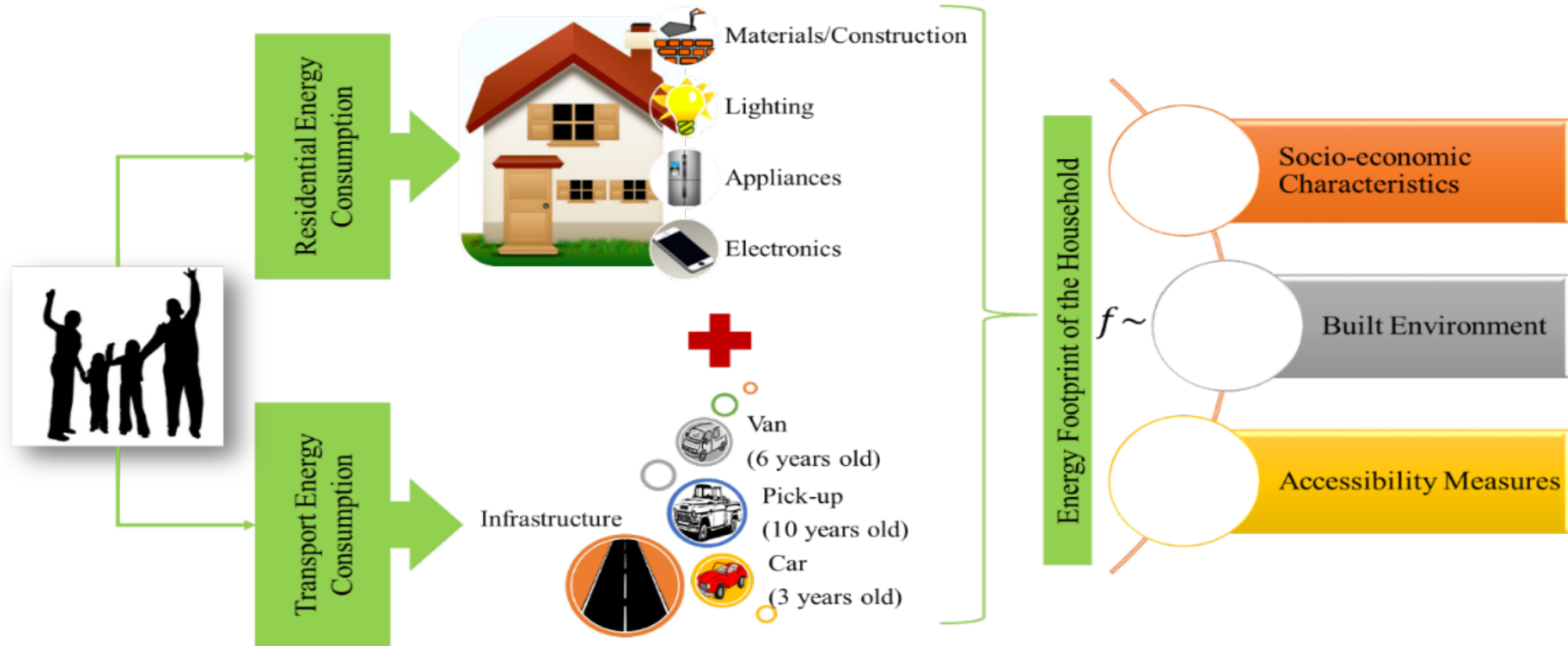


<http://tomnet-utc.org>

<http://mobilityanalytics.org>

ASU Ira A. Fulton Schools of
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Objective: Compute Total Household Energy Footprint



Inter-relationship: “ If people travel more (and spend more time outside home), they may consume **more transport energy**, but **less** in-home **residential energy**”



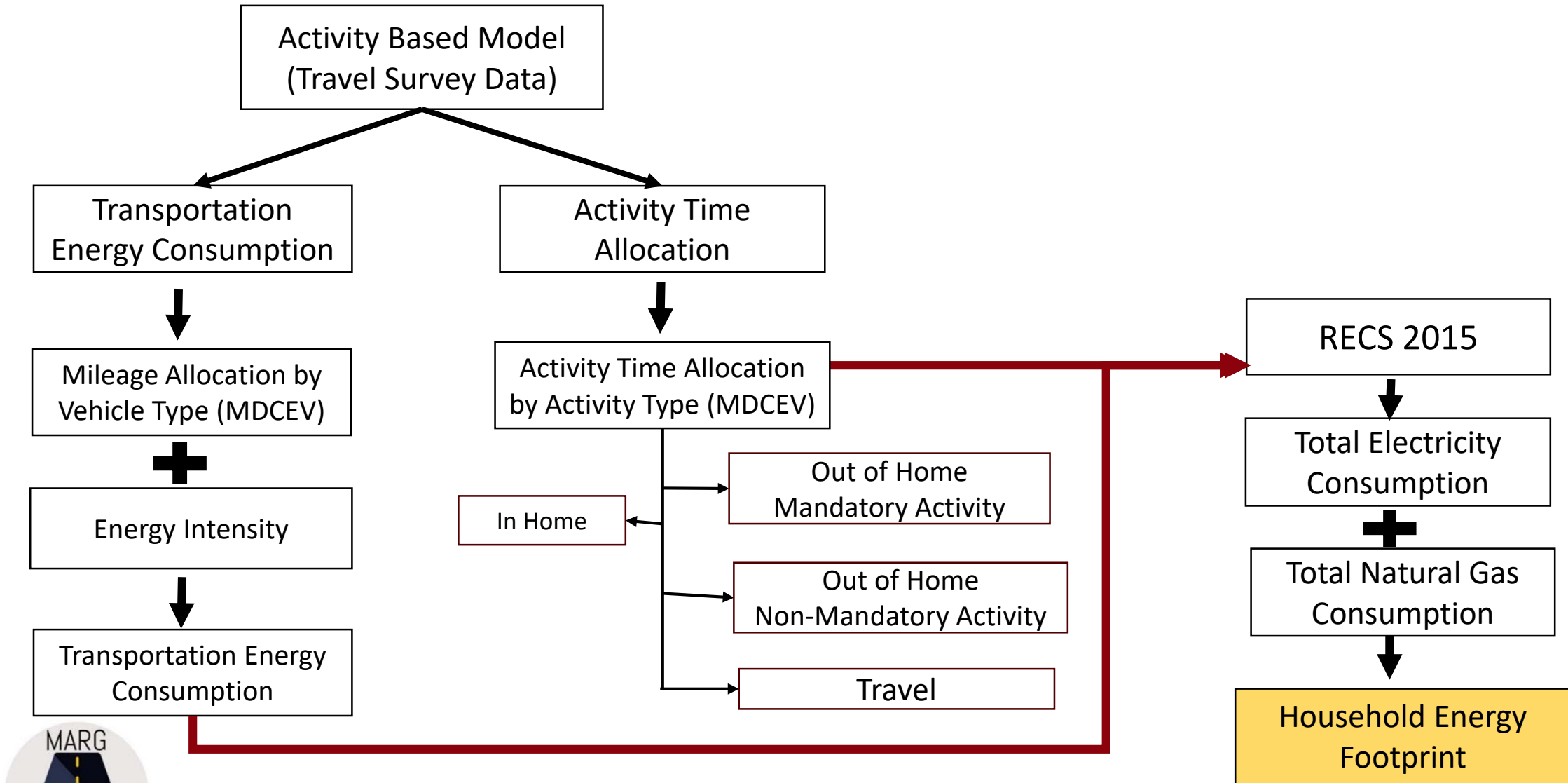
Graphic by Dr. Venu Garikapati

Data

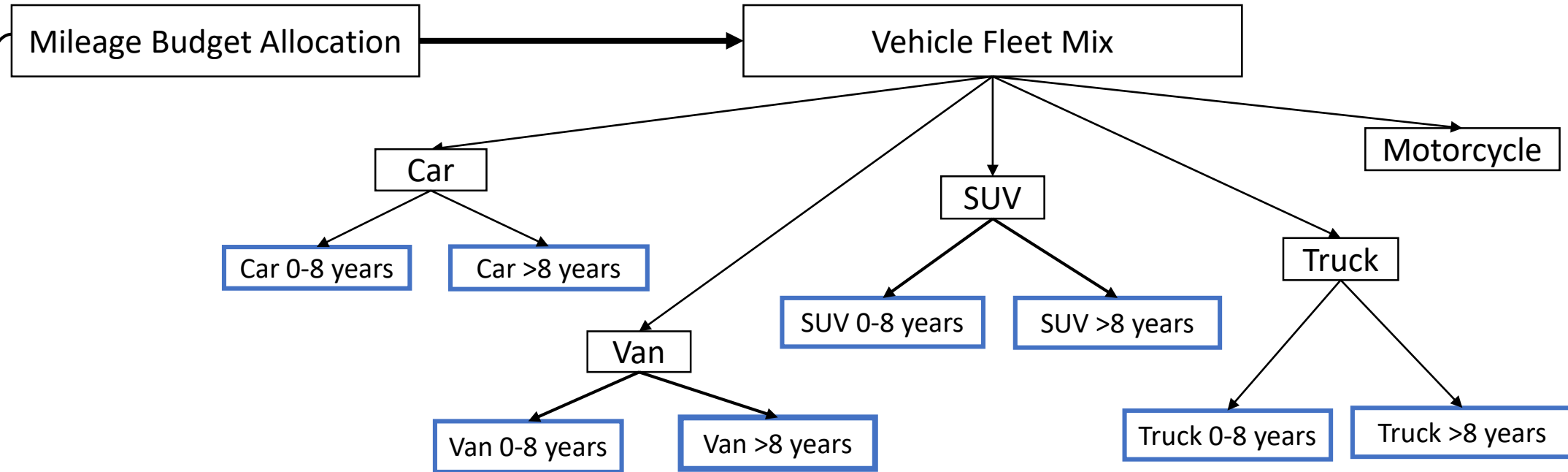
- **National Household Travel Survey (NHTS)**
 - Year: 2017
 - Sample: Random subsample of 5,686 households
 - Variables: Sociodemographic, Annual Household Mileage, and Activity Pattern
 - Geography: Entire US
- **Residential Energy Consumption Survey (RECS)**
 - Year: 2015
 - Sample: 5,686 Households
 - Variables: Household characteristics, Electricity and Natural Gas consumption, **Derived** Transportation Energy Consumption, and Activity-Time Allocation
 - Geography: Entire US



A Household Energy Modeling Framework (HEMF)



MDCEV Model of Household Vehicles and Mileage



2017-NHTS Dataset

$$\text{Transportation Energy Consumption} = \sum_{i=1}^9 (\text{Miles})_i \times (\text{Energy Intensity})_i$$



Household Energy Consumption Model Results



Energy Consumption Model (Log Regression)

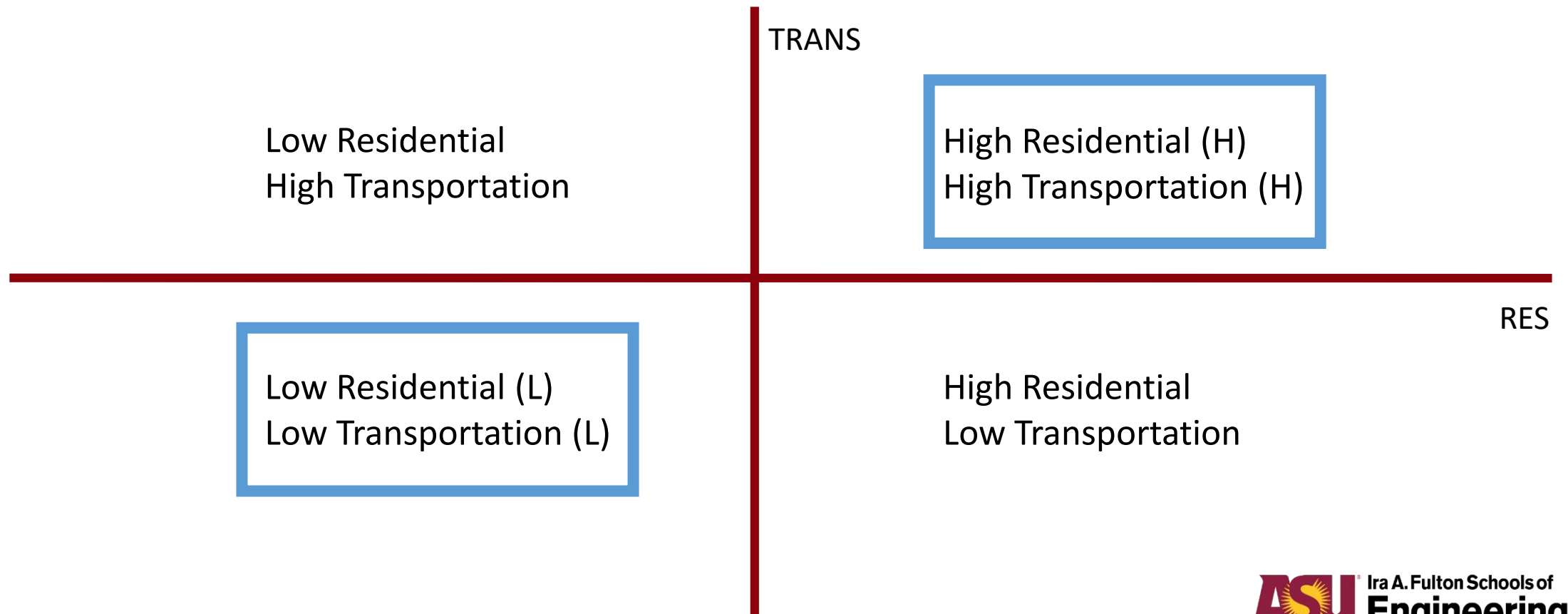
| Explanatory Variable | Electricity Consumption (N= 5,686) | Natural Gas Consumption (N= 3,302) | Total Residential Consumption (N=5,686) |
|--|---------------------------------------|---------------------------------------|--|
| In Home Activity Duration | + | + | + |
| High Income (>\$100K) | + | + | + |
| Number of Adults = 3+ | + | | + |
| Urban | — | | + |
| Number of Children = 2+ | + | + | + |
| Detached Housing Unit | + | | |
| Home Owned | | + | |
| At least One Non-Worker Present | | + | |
| Transportation Energy Consumption (in BTU) | — | + | + |
| Own Plug-in Electric Vehicle | + | | + |
| Pacific Region (WA, OR, & CA) | — | — | — |



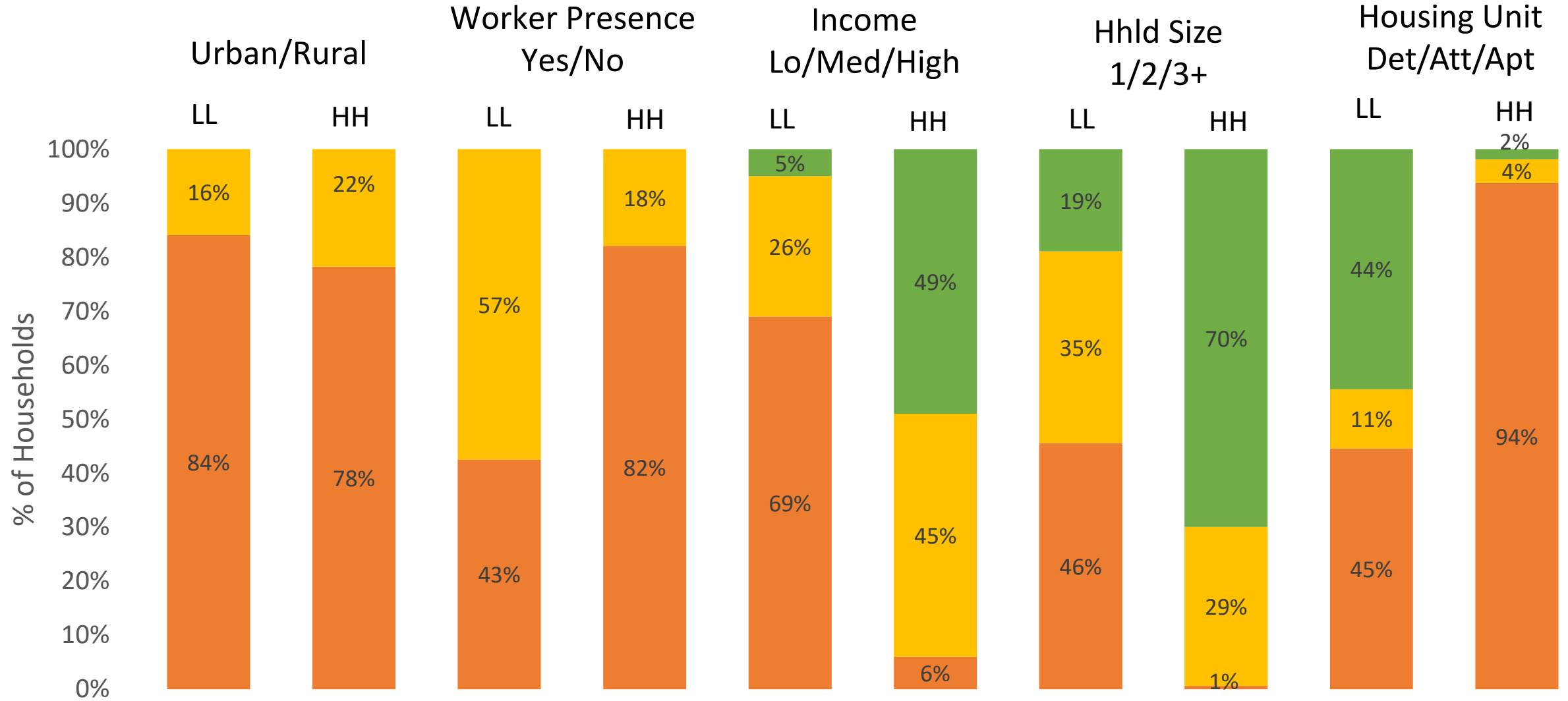
Market Segmentation

Annual Average Residential Energy Consumption/Hhld = 70,961,927 BTU

Annual Average Transportation Energy Consumption/Hhld = 72,135,531 BTU



Comparison of Low-Low vs High-High (LL vs HH)



Conclusions

- Developed an **integrated model** of **transport and household energy** that can be integrated with any activity-based travel model
- **Weak, but significant**, net complementary relationship between **transport and residential energy** consumption
- Fuses information available in travel surveys/models with information in Residential Energy Consumption Survey (RECS)



Thank You

Contact

Shivam Sharda, ssharda@asu.edu

Sara Khoeini, skhoeini@asu.edu

Ram Pendyala, pendyala@asu.edu

