



NYSERDA/American Academy Workshop

Connecting the Dots Between Theory, Simulation, and Experiments

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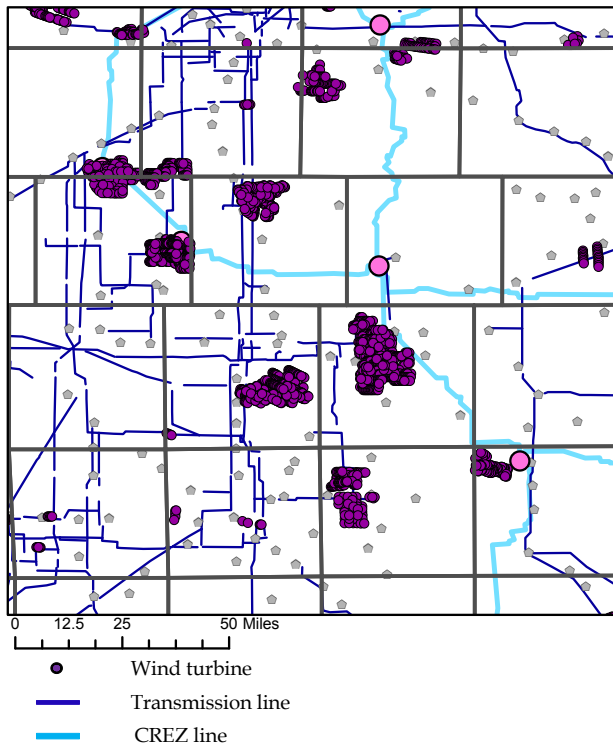
The University of Texas at Austin

18-19 June 2014, NY

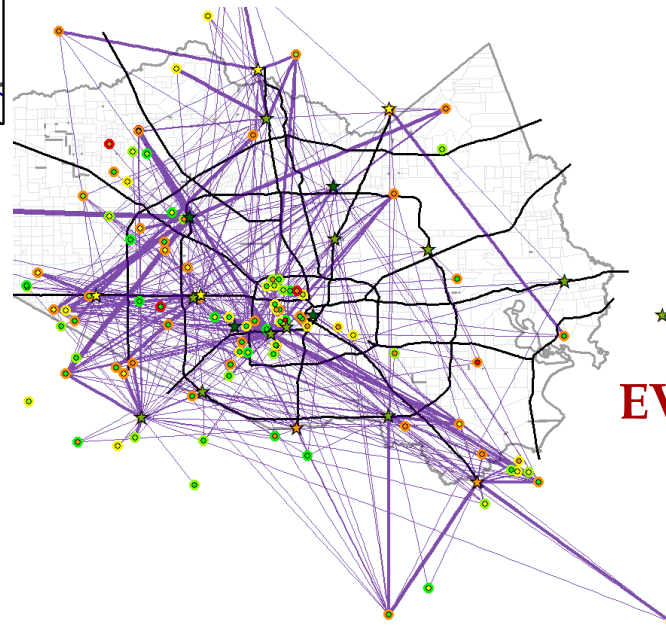
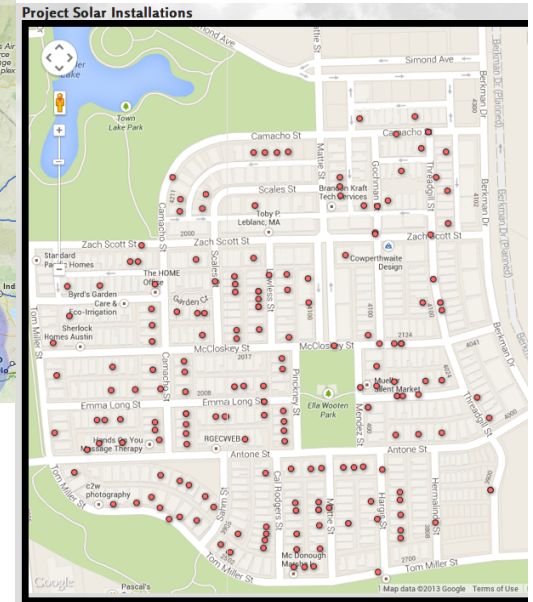
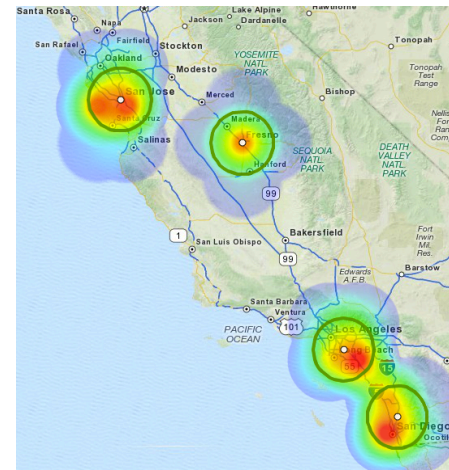


Clustering and Natural Diffusion Pathways: What Drives the Spatio-Temporal Patterns of Technology Adoption?

Transmission Lines and Wind Turbines

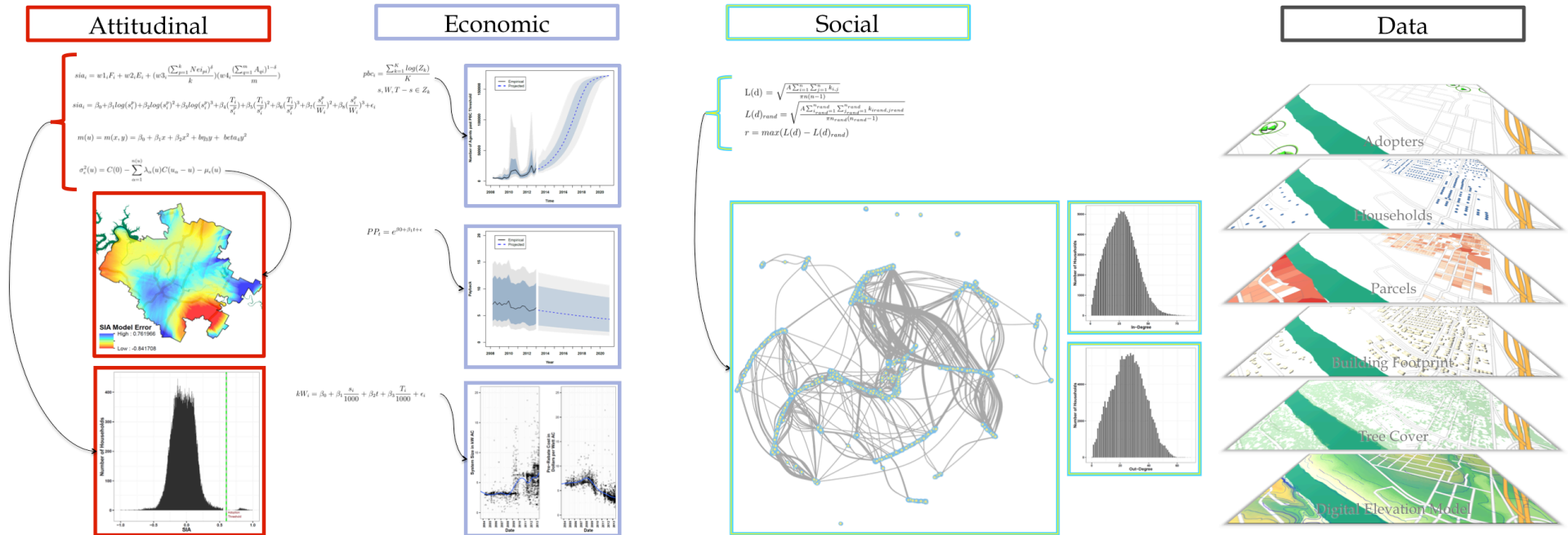


Rooftop Solar



EV Charging Behavior

Integrated Decision-Making Framework Based on Deep Data and a Suite of Analytical Tools



• Household-level Data

- Adopter and non-adopter
 - Surveys
 - Appraisal district rolls
- Solar program data
- Installer surveys

• Multi-method

- Econometric analyses
- Financial modeling
- GIS integration
- **Agent-based modeling (ABM)**

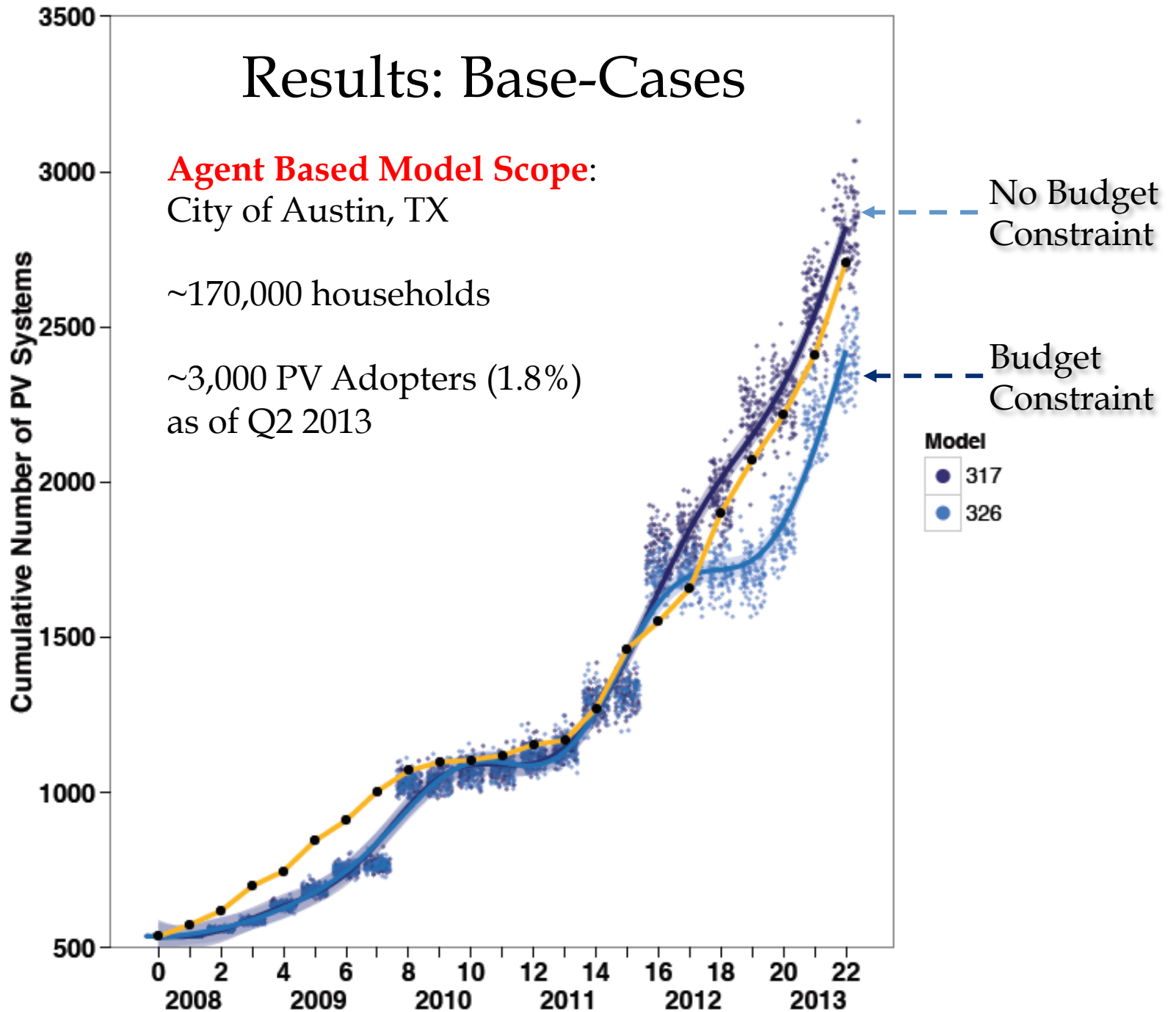
Results: Base-Cases

Agent Based Model Scope:

City of Austin, TX

~170,000 households

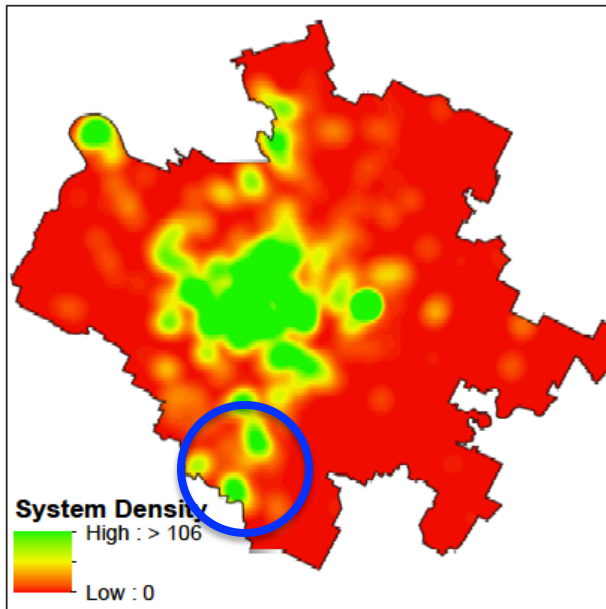
~3,000 PV Adopters (1.8%)
as of Q2 2013



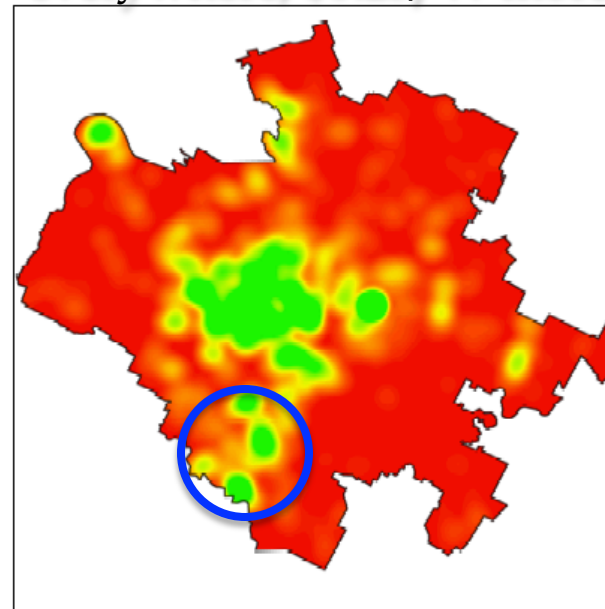
Results: Scenario, Tiered Rebates

Lower income quartile,
everywhere, \$0.25/W more

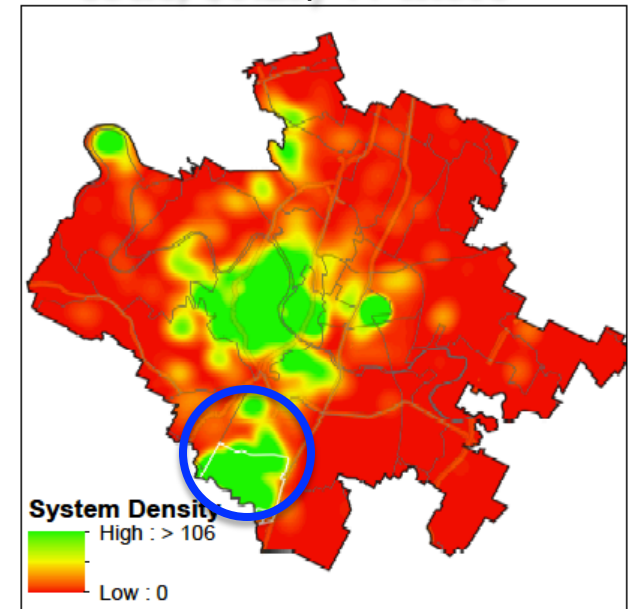
Everyone in a target zip
code, \$0.25/W more



(a) Base-case



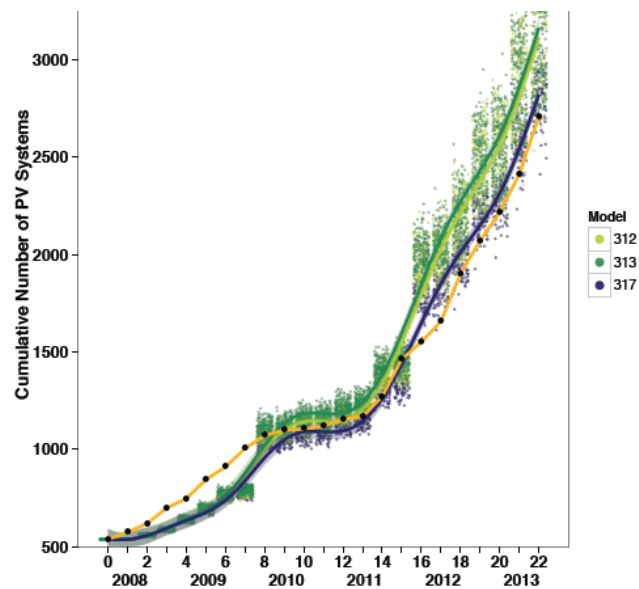
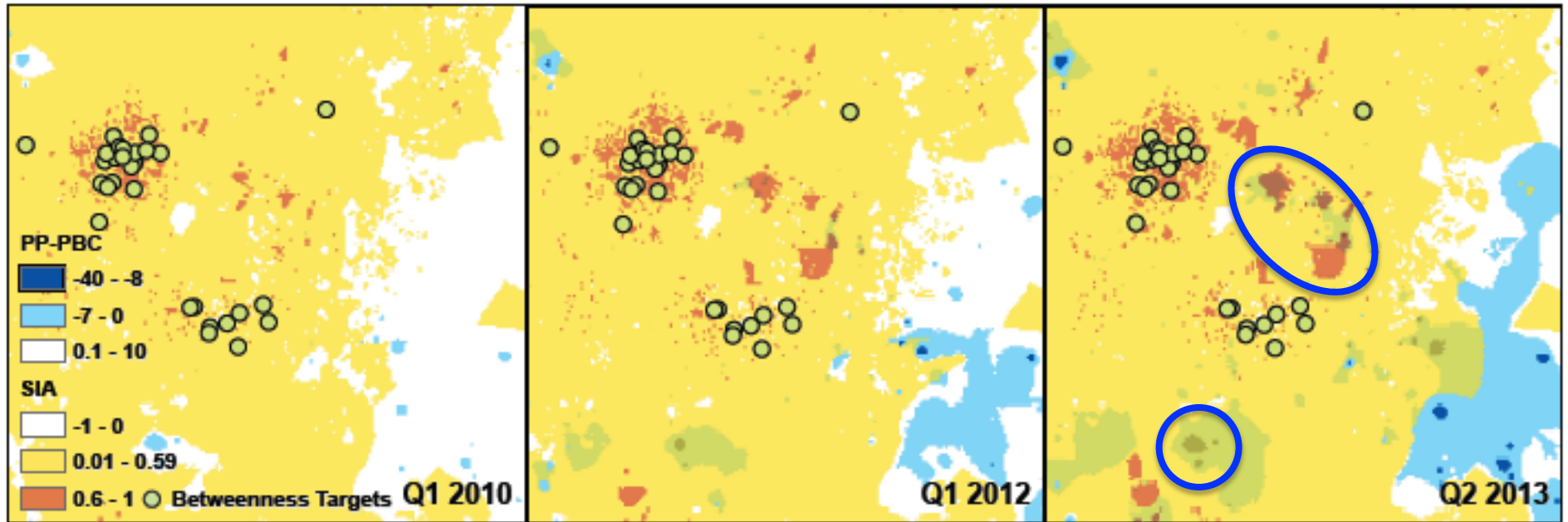
(b) Batch 327



(c) Batch 328

**Localized adoption increases
from <1% in base-case to
~11% in Sc.328**

Information Campaign, High Betweenness Nodes

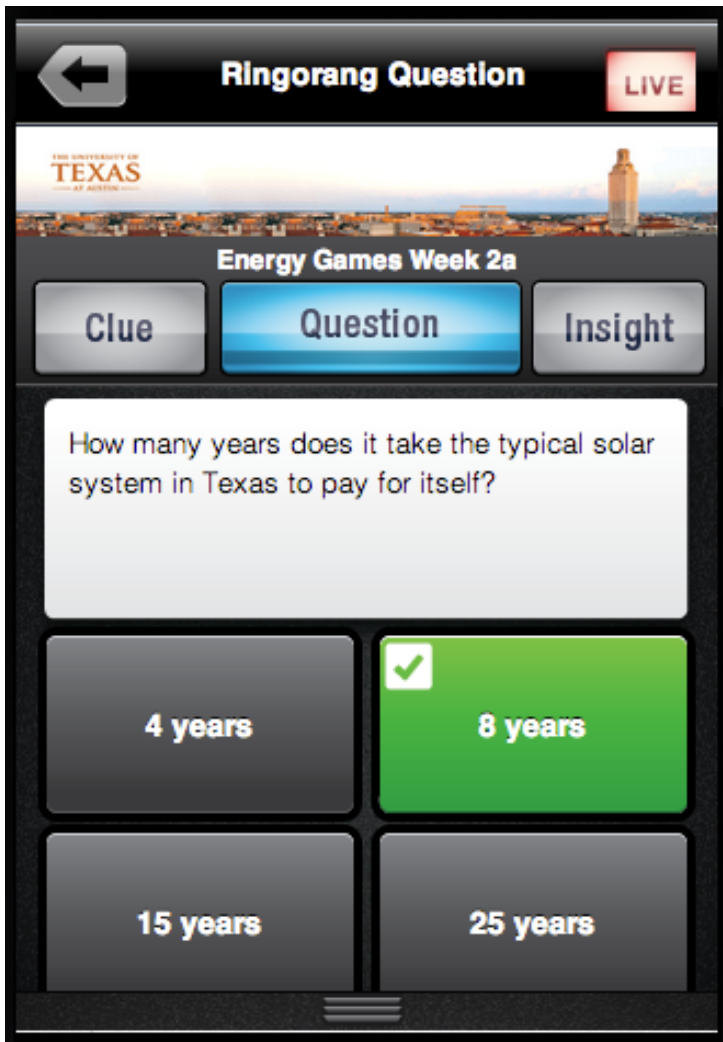


- High betweenness nodes are less clustered around the city
- Act as connectors between neighborhoods —more rapid information exchange

Experiment Goals

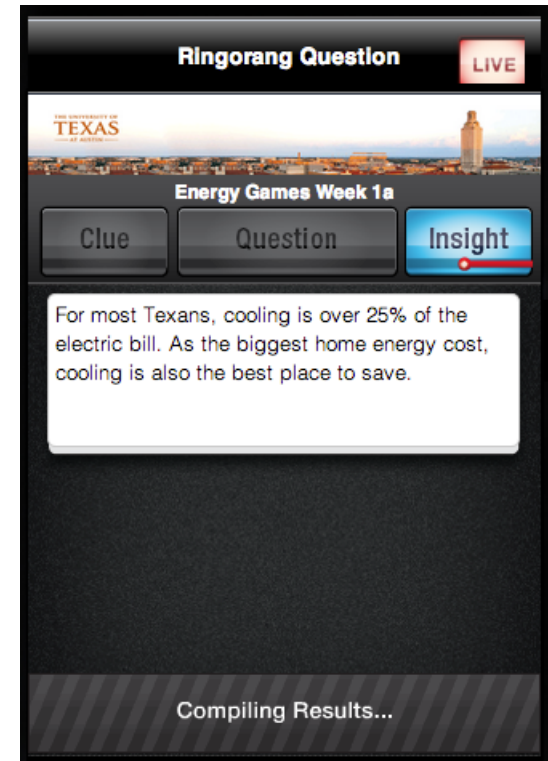
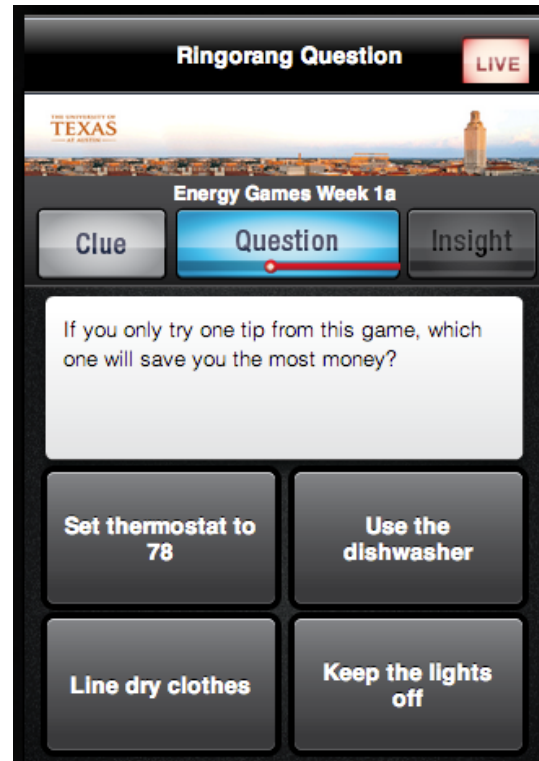
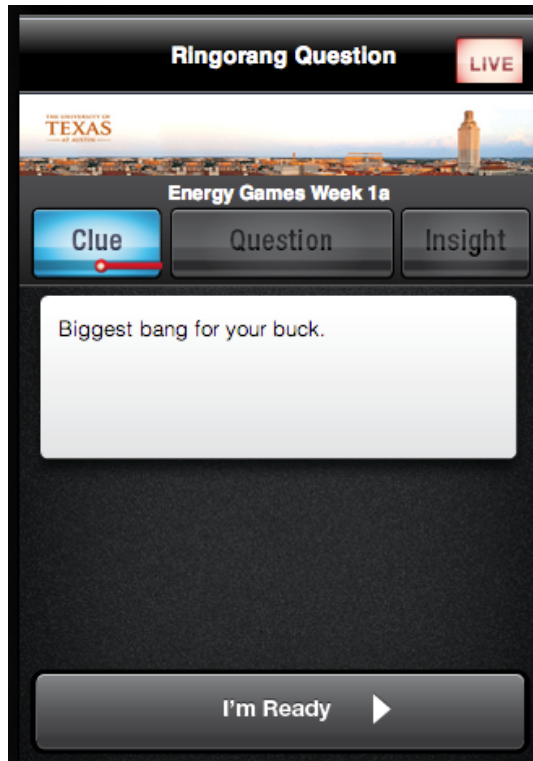
- Investigate roles of motivational drivers, social norms, and goal setting in learning about and adopting energy efficiency measures and solar PV
- Gamification based information delivery to address non-monetary costs of technology adoption
- Does the method (survey vs. gamification) of delivery impact outcomes?

Experiment Overview



- Use initial survey to capture demographics and existing attitudes and intentions regarding energy-use/solar
- Employ trivia-style mobile gaming platform to succinctly deliver key information
- Use final survey to capture changes in attitudes and intentions regarding EE/solar
- Track user activity outside game

Game Platform



- A *clue* gives a little hint to players
- A *question* conveys actionable or educational information
- An *insight* provides more context or information about the topic
- A “*learn more*” link to a web site for additional research or information on incentives
- A sliding scale for *points* based on how quickly you answer
- A *leaderboard* to compete with other players

Game Content

- **Week 1: Energy Efficiency Behavioral Measures**
 - Thermostat, water heater, and refrigerator settings, vampire power, washing machine water temperature
- **Week 2: Energy Efficient Equipment Upgrades**
 - ENERGY Star appliances, LED lighting, Insulation, Ductwork, Door and window seals
- **Week 3: Solar PV Systems**
 - Technology basics, Cost, Leasing option, Incentives/rebates

Experiment Design

<p style="text-align: center;">Pre-game Survey demographics, initial attitudes and intentions</p>								
<p style="text-align: center;">Week 1 Theme: Behavior</p>								
Question sets	<p style="text-align: center;">1.0 Motivation: Economic</p>							<p style="text-align: center;">2.0 Motivation: Environment</p>
Experiments	<p style="text-align: center;">1.1 Control</p>	<p style="text-align: center;">1.2 Goal Setting</p>				<p style="text-align: center;">1.3 Social Comparison</p>		<p style="text-align: center;">Participant numbers permitting replicates 1.0 structure</p>
Cohorts	<p style="text-align: center;">Game As Is</p>	<p style="text-align: center;">1.21 Individual, Do your best</p>	<p style="text-align: center;">1.22 Individual, Goal</p>	<p style="text-align: center;">1.23 Group, Do your best</p>	<p style="text-align: center;">1.24 Group, Goal</p>	<p style="text-align: center;">1.31 Leaderboard Viewed</p>	<p style="text-align: center;">1.32 Leaderboard Not Viewed</p>	
Games	<p style="text-align: center;">Game 1.0 Modification: Points More Visible (use for all games)</p>					<p style="text-align: center;">Game 1.1 Push Leaderboard</p>	<p style="text-align: center;">Game 1.2 Block Leaderboard</p>	<p style="text-align: center;">Game 1.3 Different Question Database</p>
<p style="text-align: center;">Week 2 Theme: Upgrades</p>								
<p style="text-align: center;">Week 3 Theme: Solar</p>								
<p style="text-align: center;">Postgame Survey Attitudes and intentions</p>								

Game-Impact Metrics

- Questions answered correctly
- Correct answers over time
- Click-through to “Learn More” sites
- Visits to utility webpages
- Pregame and postgame survey results
- Inquiries on utility energy efficiency programs
- Contacts made to installers
- Resultant solar installations/program enrollments
- Changes in energy use

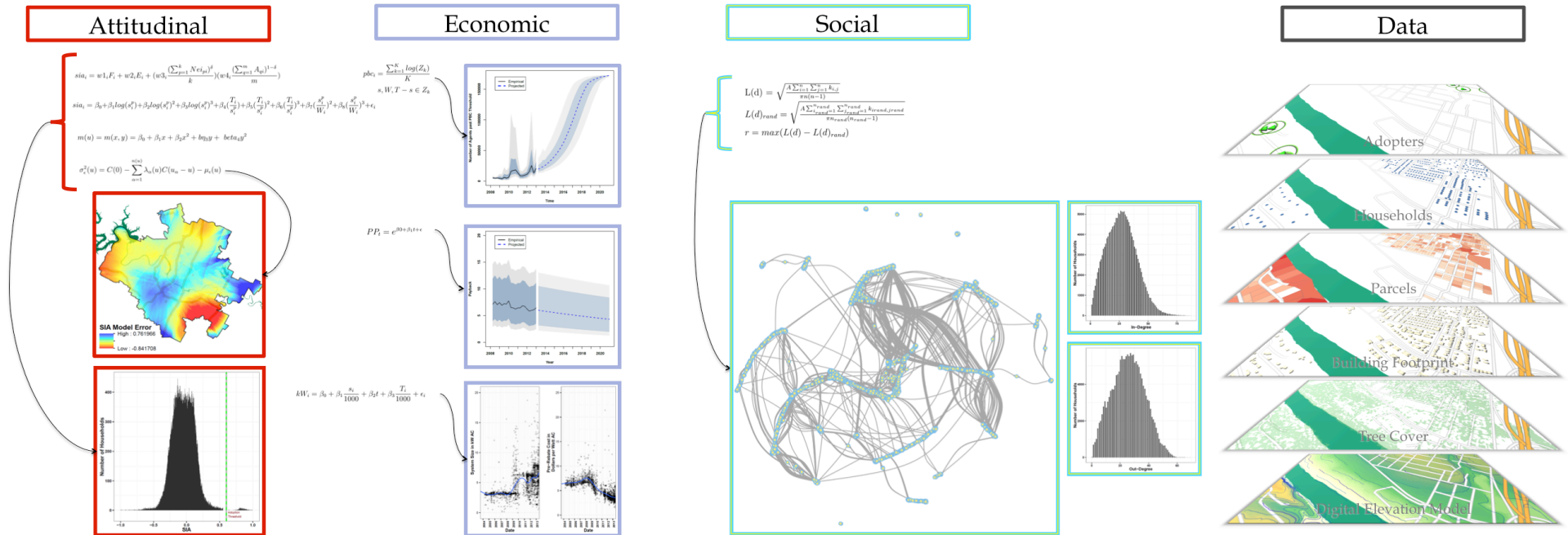
Experiment Pre-Test

- Pilot with complete game content (“Normal Game”, #1.1)
 - Fielded in Texas in May 2014; Survey ~ 100; Gameplay N ~ 25
 - Tech platform tested and validated
 - 45 questions: 5 questions/day; 3 days a week; 3 weeks (themes)
- Solar content least familiar to participants
- Drop off high for multi-week game (no incentives used)

Ongoing Work

- Marketing campaign for recruiting larger cohorts
- Establishing post-game tracking processes (several months?)
- Explore incentive options to keep participants engaged over a multi-week period (or reduce game duration)
- Does the method (survey vs. gamification) of delivery impact outcomes?
 - Additional experiment: Deliver same content in both modes

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