Quantitative Roadmap Development

LESSONS LEARNED FROM U.S. ENERGY EFFICIENCY METRICS

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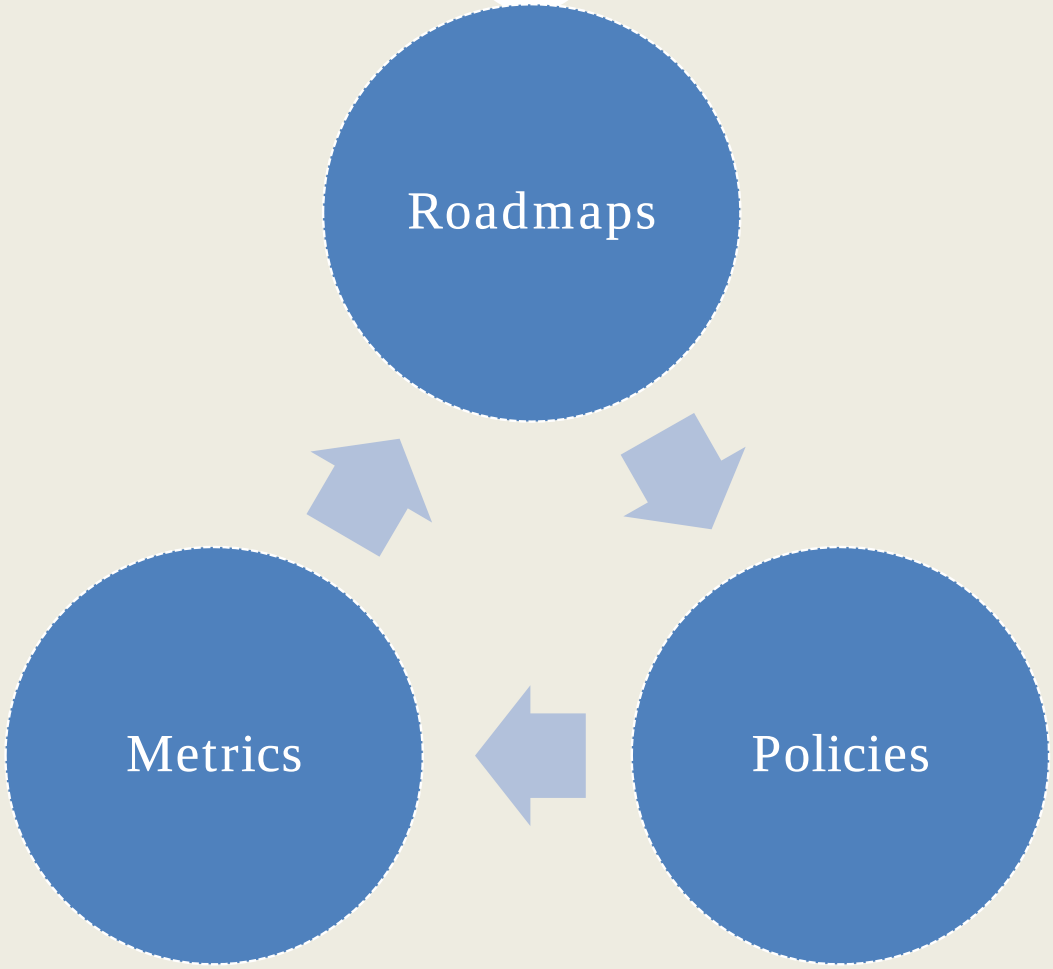
Key Questions

- How do metrics contribute to energy efficiency roadmaps?
  - Energy Efficiency Policy Cycle
- How are metrics created?
  - Successes and Challenges in Metric Methodologies
- What do current metrics tell us?
  - Metric-Based Approaches to Roadmap Development

U.S. energy efficiency metrics are relevant for many emerging technology areas.

Energy Efficiency Policy Cycle

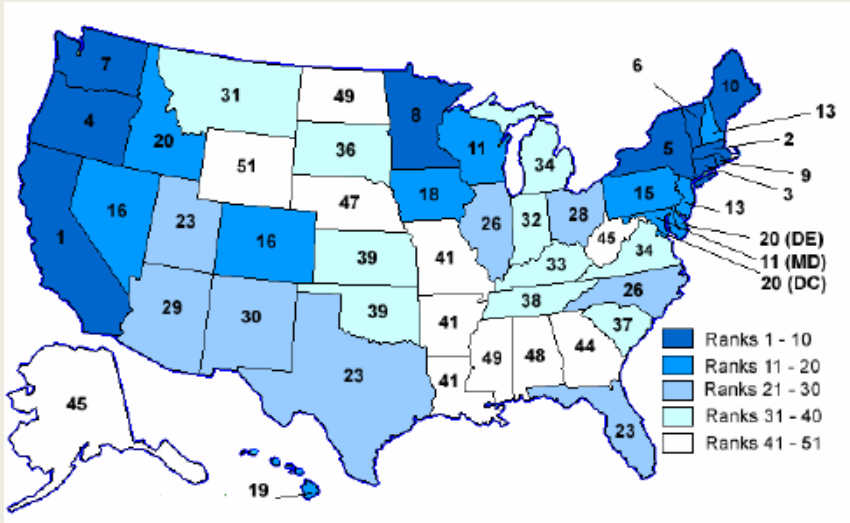


How are metrics created?

Step 1 – Determine metric objectives and audience

- Energy efficiency metrics historically guided by vague objectives
- Future approaches must emphasize clear goals: policy evaluation as a basis for future roadmap development

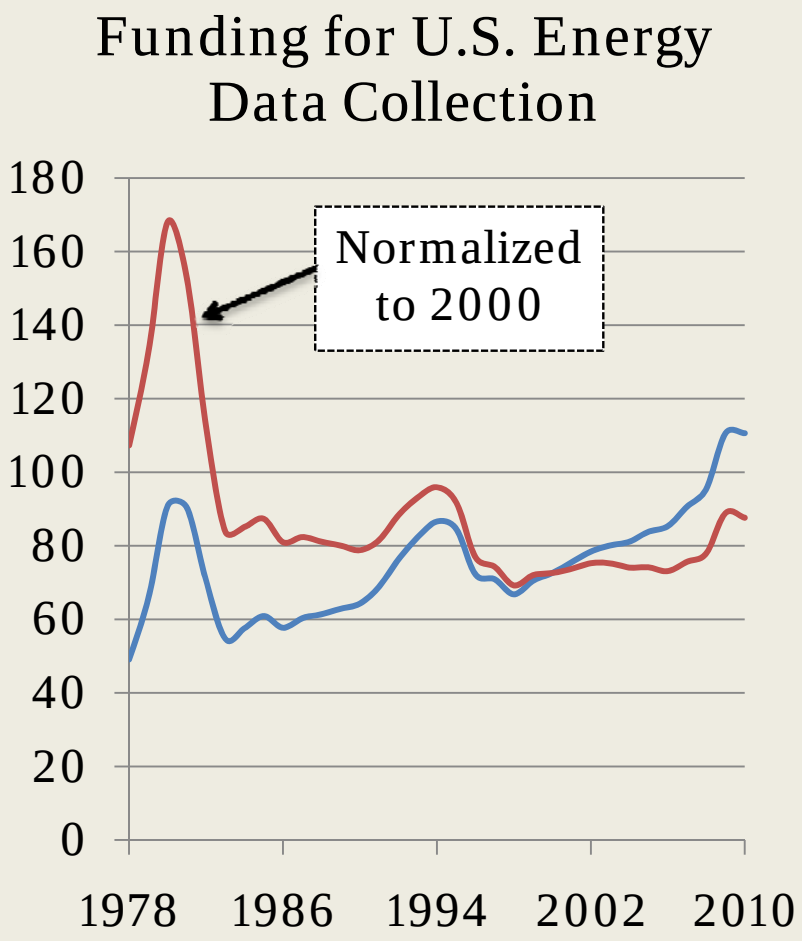
Ranking of U.S. Energy Efficiency Policies (2009)



How are metrics created?

Step 2 – Design metric using available data

- Data deficiencies constrain quality
  - Measurement frequency
  - Sample size
  - Comprehensiveness
  - Timely availability
- Lack of coordination among data collectors



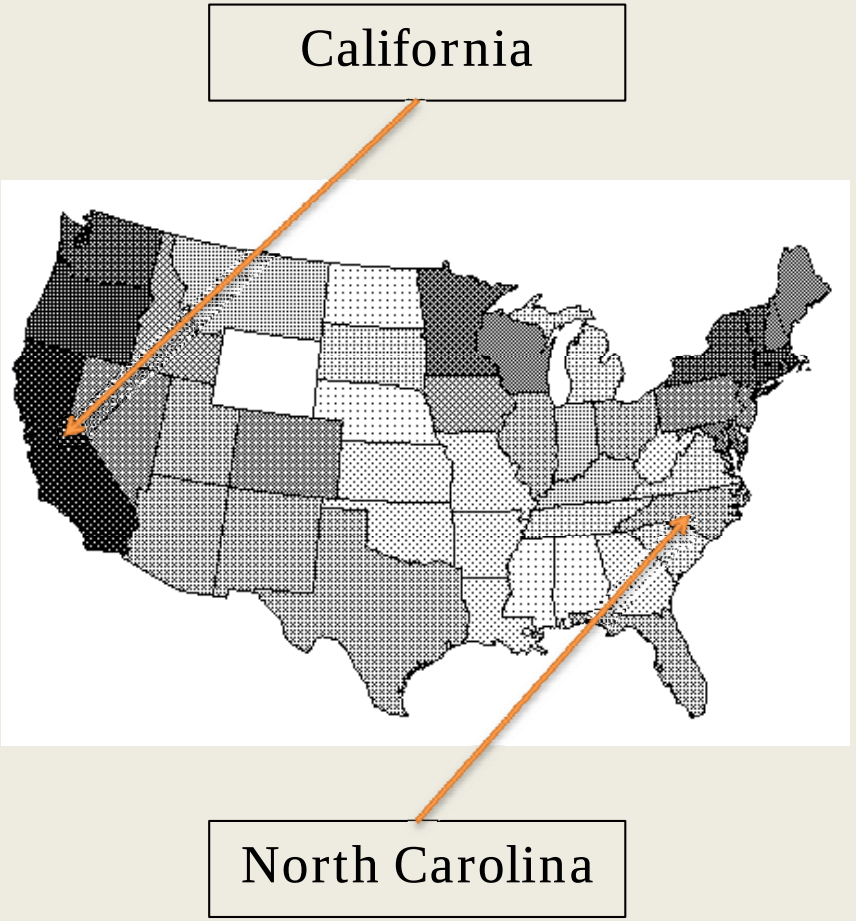
What do current metrics tell us?

In spite of current challenges, energy efficiency metrics support many research objectives.

1. Provide a basis for creating personalized policies for individual states
2. Identify quantitatively-verified pathways to improved energy efficiency

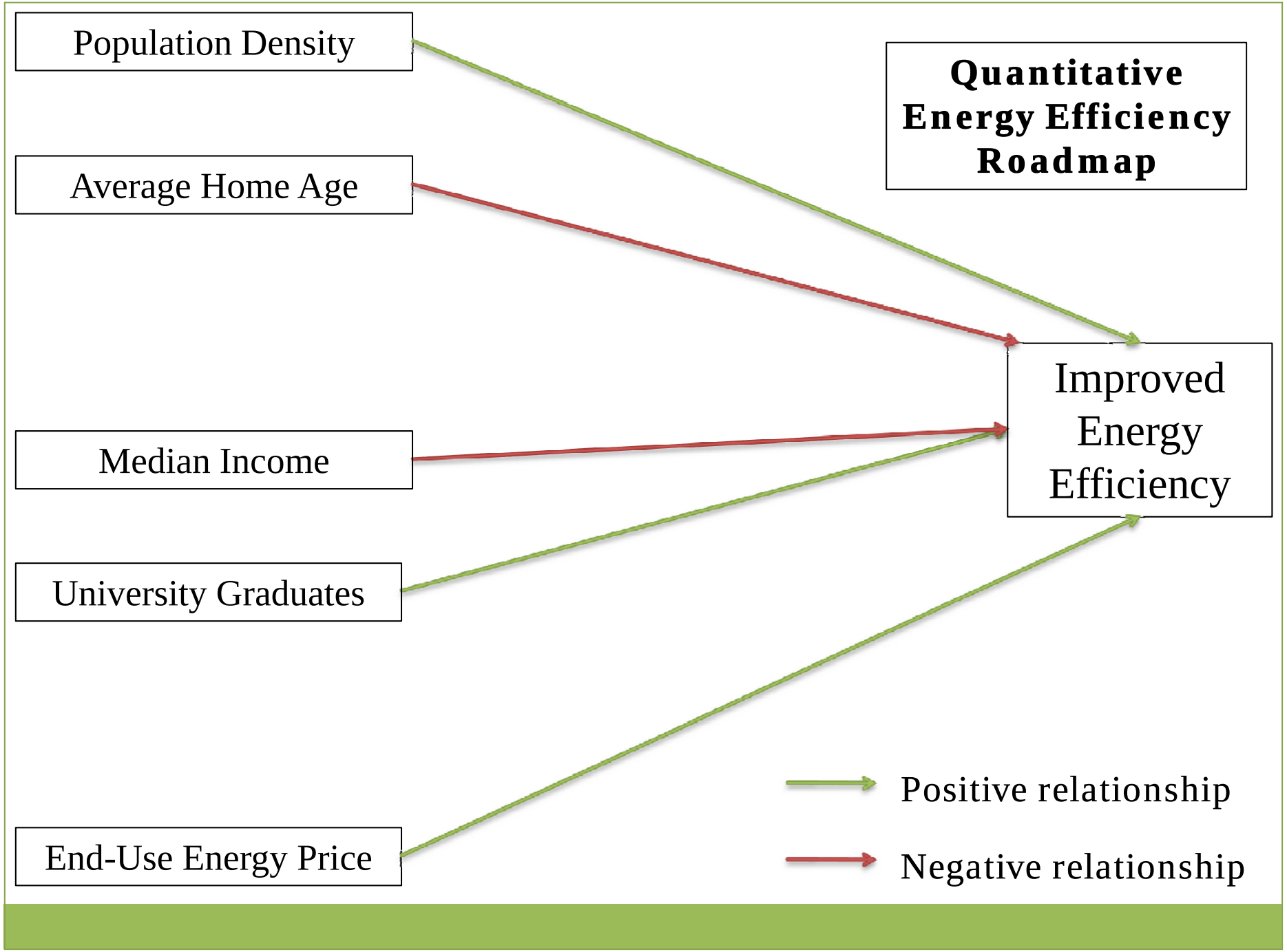
Personalized Policy Approach

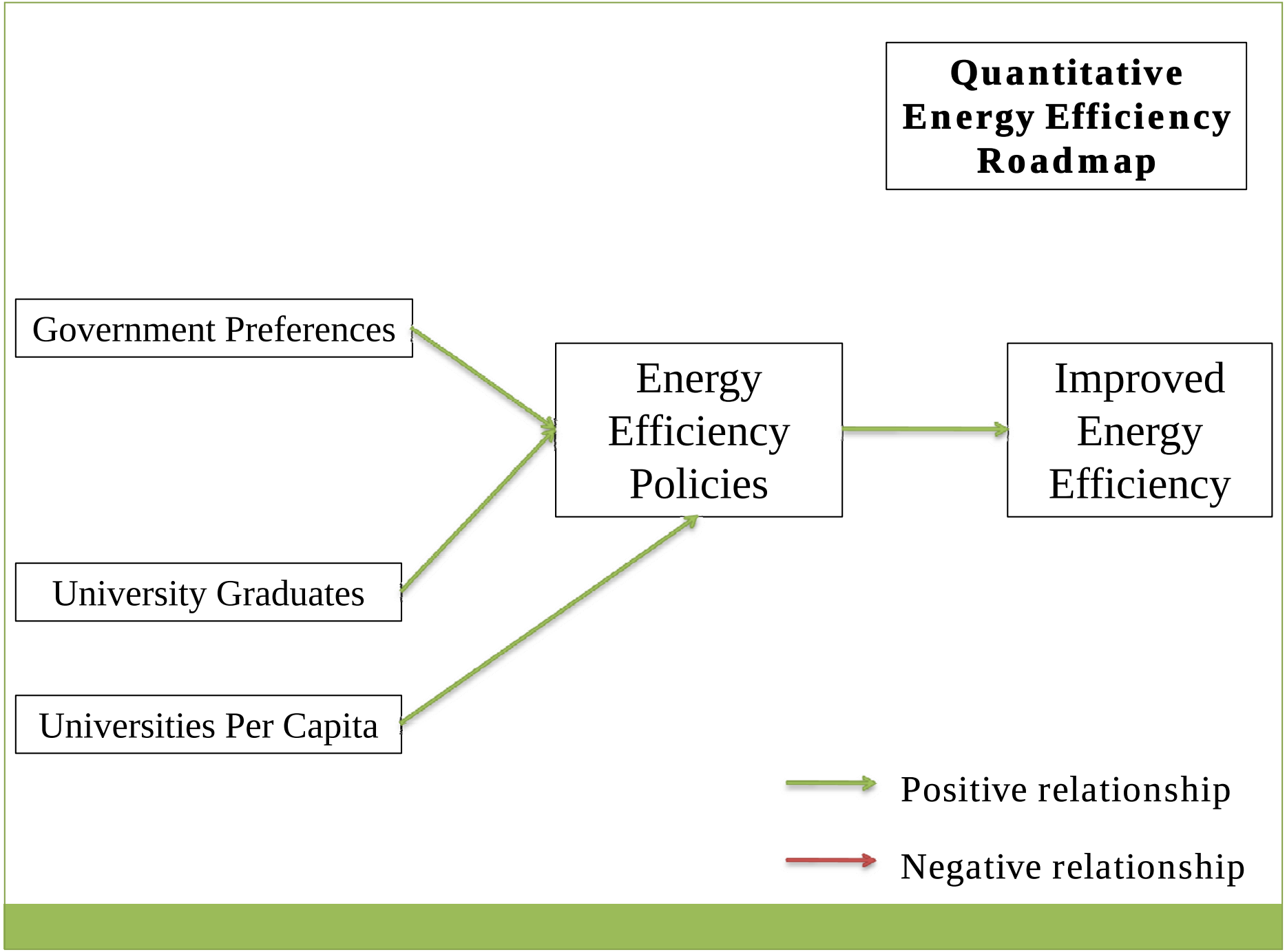
- Traditional roadmaps focus on a standard set of best practices
  - Example: California
- New approaches group states according to characteristics, then identify best practices within each group
  - Example: North Carolina



Quantitative Roadmap Approach

- **Goal** – Identify statistically-based roadmaps to improved energy efficiency in the U.S.
- **Hypothesis** – Background characteristics of individual U.S. states affect adoption of energy-efficient technologies
  - **Political mechanisms**
  - **Non-political mechanisms**
- **Methodology** – Perform path analysis using energy data and energy efficiency metrics


Population Density
Average Home Age
Median Income
University Graduates
End-Use Energy Price
Quantitative Energy Efficiency Roadmap
Improved Energy Efficiency
Positive relationship
Negative relationship


Quantitative Energy Efficiency Roadmap
Government Preferences
University Graduates
Universities Per Capita
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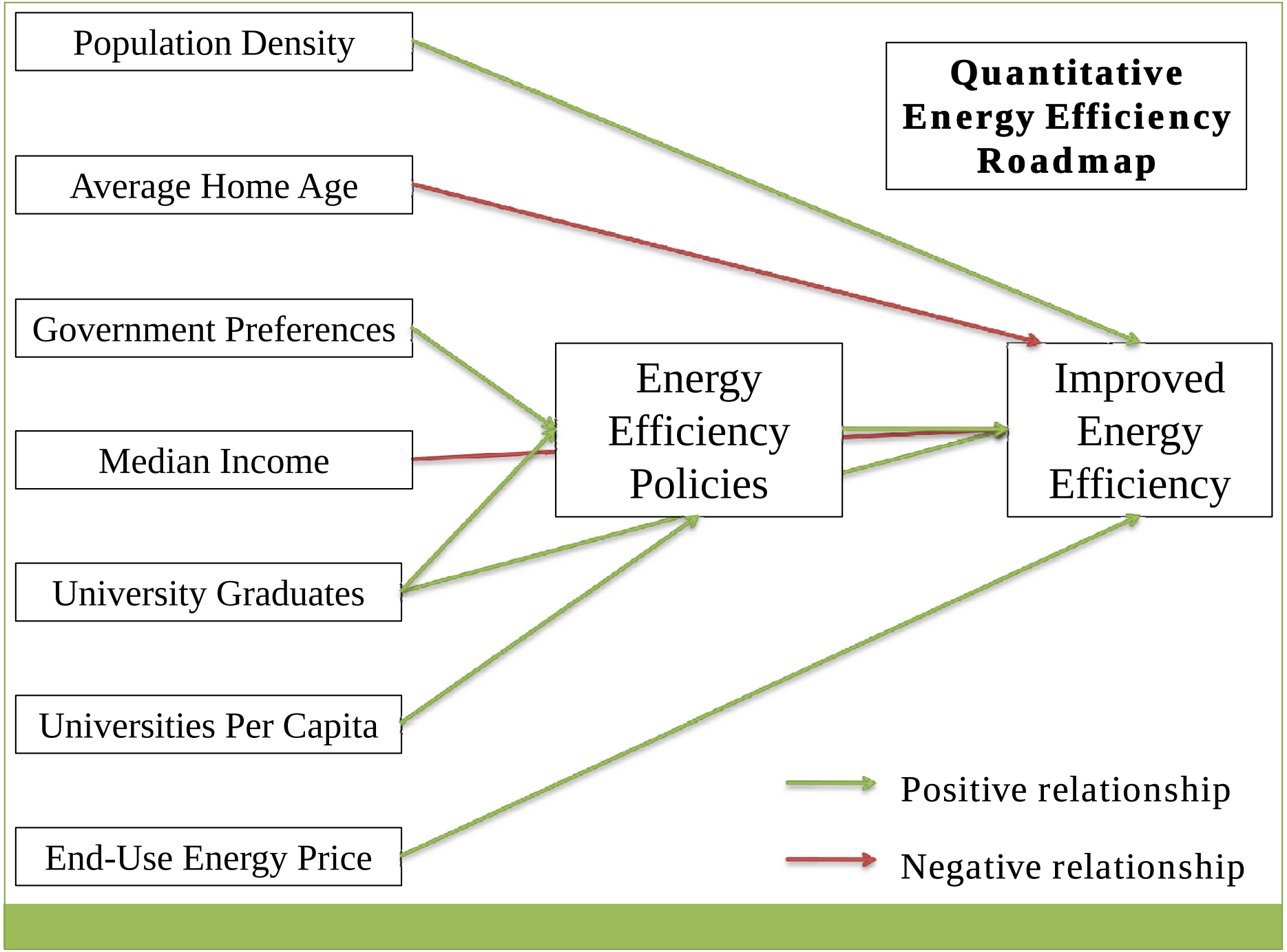
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Key Conclusions

High correlations between key predictors of energy efficiency underscore the need for a holistic energy efficiency improvement process.

Governments should identify energy efficiency roadmaps consistent with their relative strengths to maximize returns on energy efficiency investments.

Future Research Directions

- Improve energy efficiency metrics
  - Enhance energy data collection
- Further develop quantitative roadmaps
  - Correlation analysis and path modeling
- Analyze of specific pathways/roadmaps
  - Generate detailed policy recommendations
- Expand approach to integrated geographical scales
  - International and regional perspectives