

Sociotechnical Systems to Enable Smart & Connected Energy-Aware Residential Communities #1737591 (IRG – 1, FY2017)

Purdue University : PI: Panagiota Karava; **Co-PI's**: Ilias Bilonis, James Braun, Thanh Nguyen, Julia Rayz, Leigh Raymond, Torsten Reimer
Students: Huijeong Kim, Vanessa Kwarteng, Hemanth Devarapalli, Tatiana Ringenberg, Geetanjali Bihani, Hayden C Barber, Jeonghyun Oh, Danim Zhang, Hyeongseok Lee
Communities Partners : Garry Hobbs (BWI), Jacob Sipe (Indiana Housing and Community Development Authority, IHCA)

Community-identified Problem

ihcda
Launches Moving Forward program

BWi
Builds innovative housing communities

PURDUE UNIVERSITY
Conducts sociotechnical research and develops new S&C resident engagement technology

Vision

Develop new S&C technology to engage community residents in understanding and reducing their home energy use while increasing their environmental awareness and improving their quality of life.

Intellectual Merit

Use-Inspired Research

Fundamental Contributions

- Physics-informed machine learning for energy model identification
- Energy-feedback mechanism design
- Social game design

Outcomes

- 2017 Baseline data/energy analytics
- 2018 Eco-feedback mechanism
- 2019 MySmartE app development
- 2020 Deployment of MySmartE app in 94 Indiana households
- 2021 Mechanism design
- 2022 Scale-up, transition to practice

Project Activities

Pilot Deployment of MySmartE

- Fort Wayne: 44 units Low-income community for scholars
- Indianapolis: 50 units Low-income community

Positive effect of the intervention for all units for which baseline and intervention data were available.
>20-30% community energy savings

Scalability research

Human decision-making

Positive impact of eco-feedback ($f^0 > 0$)

Mechanism Design

Conceptual framework

Community decision trend

Broader Impact

- Develop new smart home energy management system that works with a tablet and Amazon Alexa.
- Empower affordable housing residents reduce their energy bills.
- Enable government (cities/states, housing authorities) and industry stakeholders (community developers, utility companies, energy aggregators) to design and deploy new energy efficiency programs.

Resident interviews

The results from post-experiment interviews revealed that:

- Residents became more energy-aware after using MySmartE. (e.g., "I think it's great...It is definitely helping me to be more conscientious of my energy usage..."). Also, residents said that they were thermally comfortable in their home while they were saving energy.
- The social game elements such as avatars or social proof information excited residents during the game (e.g. "It encouraged me...oh ok, we are doing this, and we have this to achieve, it was a really fun thing for me").

Explainable AI

Example: "My score is so low" -> Classify to "Score is too low" -> Pre-trained AI analyze the reasons / Weight analysis to understand solution -> To score more...

Sustainability

PATENT REGISTRATION

SCALE-UP DEPLOYMENT

TRANSITION TO PRACTICE

1,000 units with different construction types and demographics

What's Next

Startup company -> **Deployment Across the U.S. - National model**

Slide 1

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