

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

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Communities Partners : Garry Hobbs (BWI), Rod Watts (BWI), Jacob Sipe (Indiana Housing and Community Development Authority, IHCD)

Project Overview - Vision

IHCDA: develops Moving Forward program

BWI: builds innovative housing communities

Purdue: develops new S&C user-interactive devices

Our pilot: demonstrates SmartE app in 94 Indiana households

- Our vision: Realize energy-aware communities that engage residents in understanding and reducing their home energy use
- Quality of life improvement in low- and moderate-income households

Community Need & Intellectual Merit

Moving Forward Program
Innovative solutions to reduce housing and transportation costs for low/moderate income communities

BWI-Purdue partnership
New technology to empower affordable housing residents reduce their energy bills

44 units Low-income community for scholars
50 units Low-income community

Sociotechnical advancements

Physics-informed machine learning for energy model identification

Decision making for energy-feedback and social game design

SmartE App demonstration

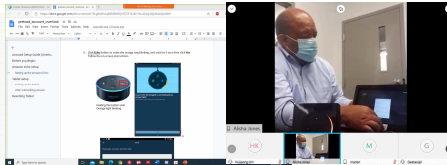
BWI employee

Community resident

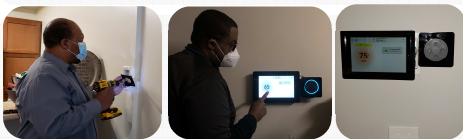
Project Update

Community Deployment

Online training for BWI team



On-site installation



New user onboarding

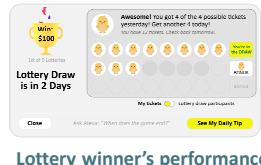


Winners

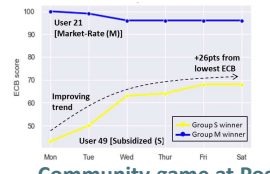


Social Games

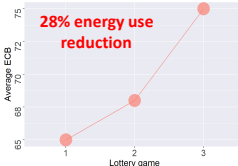
Lottery game at Overlook



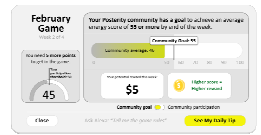
Lottery winner's performance



- Competitive game with \$100 valued bi-weekly lottery
- 30 out of 50 households, Feb 1st – Mar 28th
- Weekly community scores

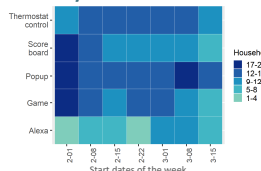


Community game at Posterty Heights

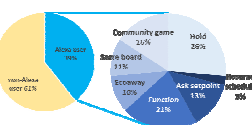


- Collaborative monthly game with 4 sub-weekly shared goals and rewards
- 27 out of 44 households, Feb 1st – Mar 28th
- 20% HVAC energy use reduction

Weekly user interactions

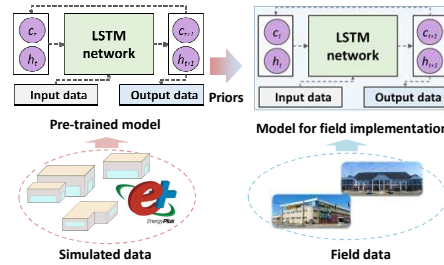


Alexa user interactions

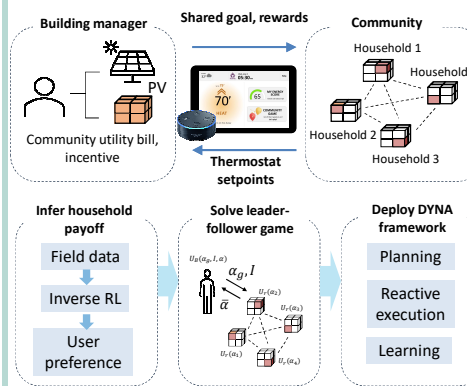


Sociotechnical Model

Deep-learning-based energy model



Mechanism design for community game



Broader impact

Immediate Impact on Society

- Cost Savings for the Owner** - Deployment of SmartE resulted in >20-30% energy savings, i.e., >\$3000 utility bill savings during the heating season for each of the two communities that participated in our pilot study.
- Improved Quality of Life for the Residents** - Part of the savings are distributed to residents in the form of gift cards, credit in the car-sharing program, and community investments (e.g. new playground).
- Integrated Data sharing for Secondary Users** - S&C technology creates an integrated tool to monetize and manage information more effectively (i.e. preventative maintenance, advertisers, manufacturers, etc).

Sustainability

- Impact > 40,000 households across the IHCD system
- Create a national model for S&C energy-aware communities

What's Next

- Long-term behavior analysis**
 - Evaluate long-term resident engagement, S&C technology adoption, and community impact
- Community Incentive optimization**
 - Develop a software platform to optimize incentives and generalize results.