Community Energy: Technical and Social Challenges, and Integrative Solutions

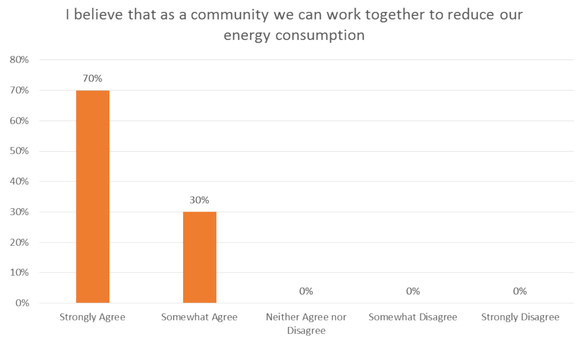
Abstract

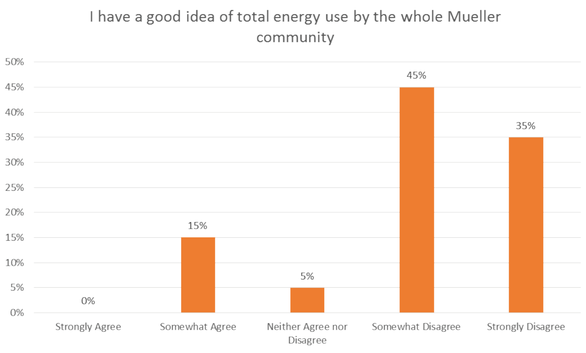
There is an urgent need to improve the reliability and resilience of the electric grid and to integrate new technologies such as rooftop solar, battery storage and electric vehicles. These technologies can strain an aging grid that was not designed to handle them, but if managed properly can actually provide valuable resources to the grid such as demand response and load shifting. These benefits are greater if aggregated at the community level. However, this requires gaining the understanding and participation of community members and developing tools to analyze, visualize and communicate large, heterogeneous datasets to a variety of stakeholders. This multidisciplinary, integrative project addresses these issues through (1) identifying and engaging key community stakeholders, (2) conducting community workshops and implementing a survey of community members in the Mueller neighborhood (3) developing data analytics, visualization and communication tools that integrate data on electricity use, weather, and location factors, in consultation with targeted stakeholders and community members, and (4) developing a full proposal to implement the Community Energy program in the Mueller community

Methodology

To address these issues, this planning project brings together residents and stakeholders in the Mueller community of Austin, Texas, to create knowledge and tools to develop a Community Energy program that will serve as a model for other communities across the U.S. Planning and developing such a project will engage residents and stakeholders at each stage to maximize the probability of success. The results of the research will be published in academic, policy and practitioner outlets, and the data analysis and visualization tools will be distributed freely to researchers, policymakers and practitioners. The planning project will support and train graduate students at Syracuse University in research methods that integrate social science and data science in an active research setting.

Survey Results





Next Steps

We would like to receive a wider range of feedback from the community, regarding their response to energy culture, community energy as a concept, and the dashboard design. We would also like to include a simulation component to the dashboard as a way to project energy use.

Research Approach

The concept of Community Energy involves integrating small-scale solar power, demand management and energy storage at the community level to create economic, environmental and social value for individuals and communities while improving the reliability and resilience of the electric grid.

While this concept has great potential benefits, it raises a number of conceptual issues that must be addressed to realize its potential. These include:

(1) How economic and behavioral incentives are perceived and valued in a community context and whether these differ from the perceptions and values of individual energy users;

(2) How residents and other stakeholders will perceive such a project and what factors affect their acceptance and participation;

(3) How highly granular data can be analyzed, visualized, and communicated to encourage acceptance and facilitate participation in a Community Energy program.

Objectives

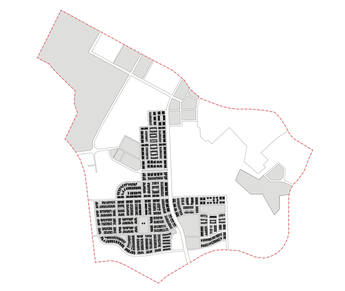
Phase 1 focuses on designing a dashboard interface for visualizing internal energy use/demand and external energy resources/supply in the Austin, TX, Mueller neighborhood using currently acquired energy-use datasets from the Pecan Street Institute. Subtasks include:

1. Assessing dashboard purpose, target audience (stakeholder analysis), and graphic content.

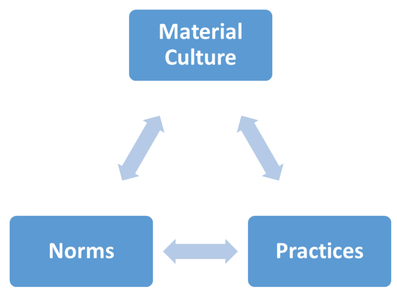
2. Designing wireframe structure and layout, information hierarchy, interactivity, inter-scalar navigation logic, and style tiles/graphic identity.

3. Prototyping (blueprints) using Photoshop or a web framework

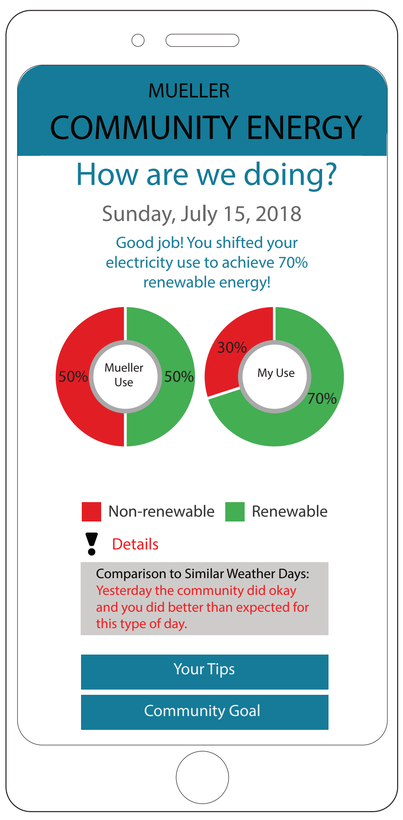
Mueller, Austin, Texas



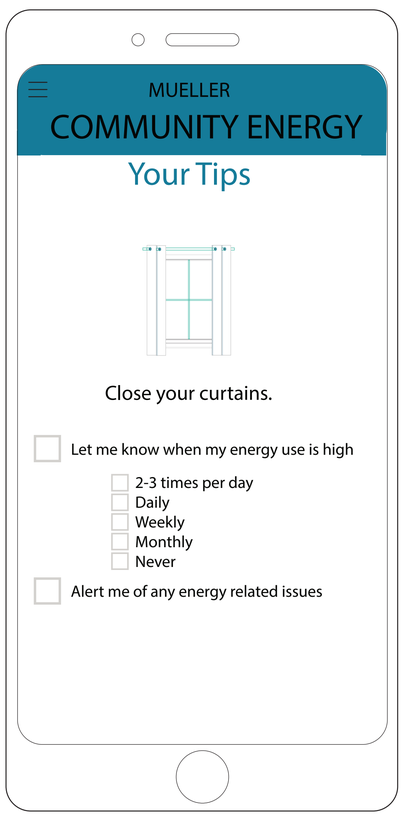
The Energy Cultures Framework



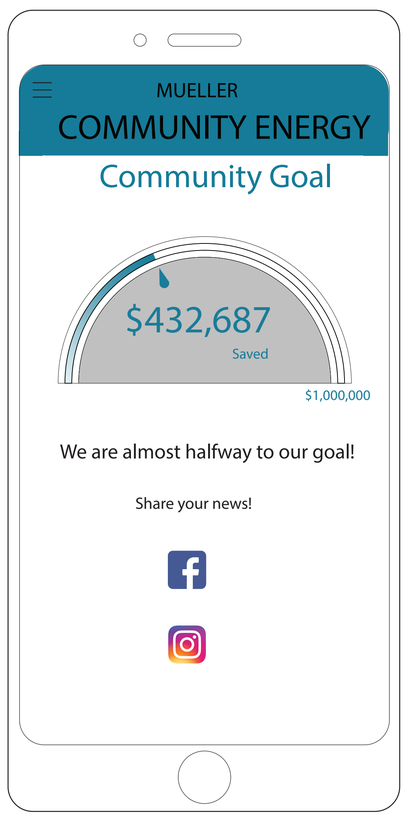
Ford, R., Karlin, B., & Frantz, C. (2016). Evaluating Energy Culture: Identifying and Validating Measures for Behavior-based Energy Interventions.



The home page indicates the use of renewable and non-renewable energy both on the individual and community level. Use is compared to previous days as a way to indicate energy savings.

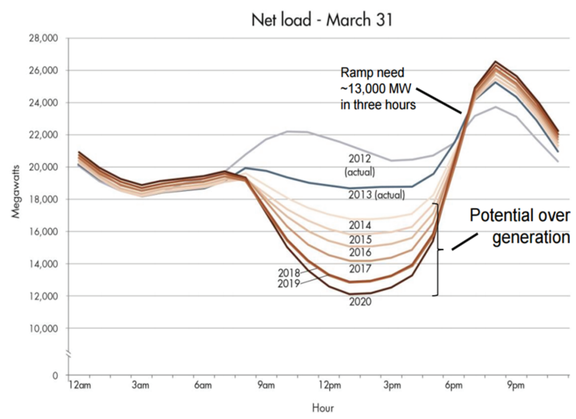


Individual profiles can contribute to saving energy by utilizing a notification, alert and tip system. Frequency is decided based on the individual profile.

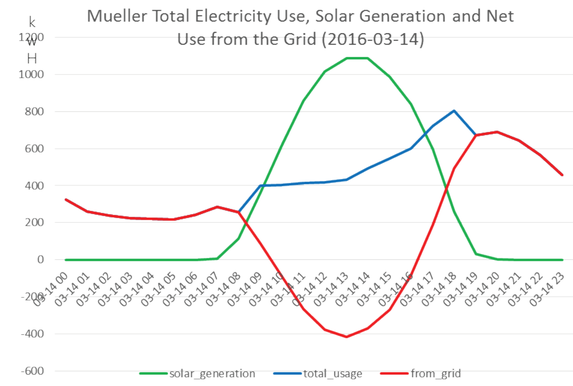


Individual savings can contribute to the overall community goal as a gamification method. The progress of the community can be linked to social media or a community forum.

California Duck Curve



Mueller Community Duck Curve



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