



Responding to Energy Insecurity in Arctic Housing Using Community-Based Participatory Research



Dr. Kristen Cetin¹, Dr. Cristina Poleacovschi², Dr. Jessica Sanigaq Ullrich³, Dr. Bill Gallus², Dr. Bora Cetin¹
Christiana Kiesling¹, Patricia Guillante¹, Amanda Yaa Nkansah Quarshie²
Michigan State University¹, Iowa State University², University of Alaska Anchorage³

Introduction

Rural communities in Alaska face **many housing challenges**. Existing housing is generally older, overcrowded, inefficient, and poorly equipped to withstand extreme weather conditions, resulting in a **high energy burden on homeowners** and **indoor environmental quality challenges**. While there have been substantial efforts to support **weatherization** in these communities, the efficacy, service life, and homeowner use of such improvements can be better understood to further improve energy efficiency.

Existing challenges

- (a) Housing is **inefficient** causing significant energy burden
- (b) Housing vulnerabilities **impact** people's **well being** and quality of life
- (c) Some retrofits are **not being used** or **performing as designed**

New challenges in a changing climate

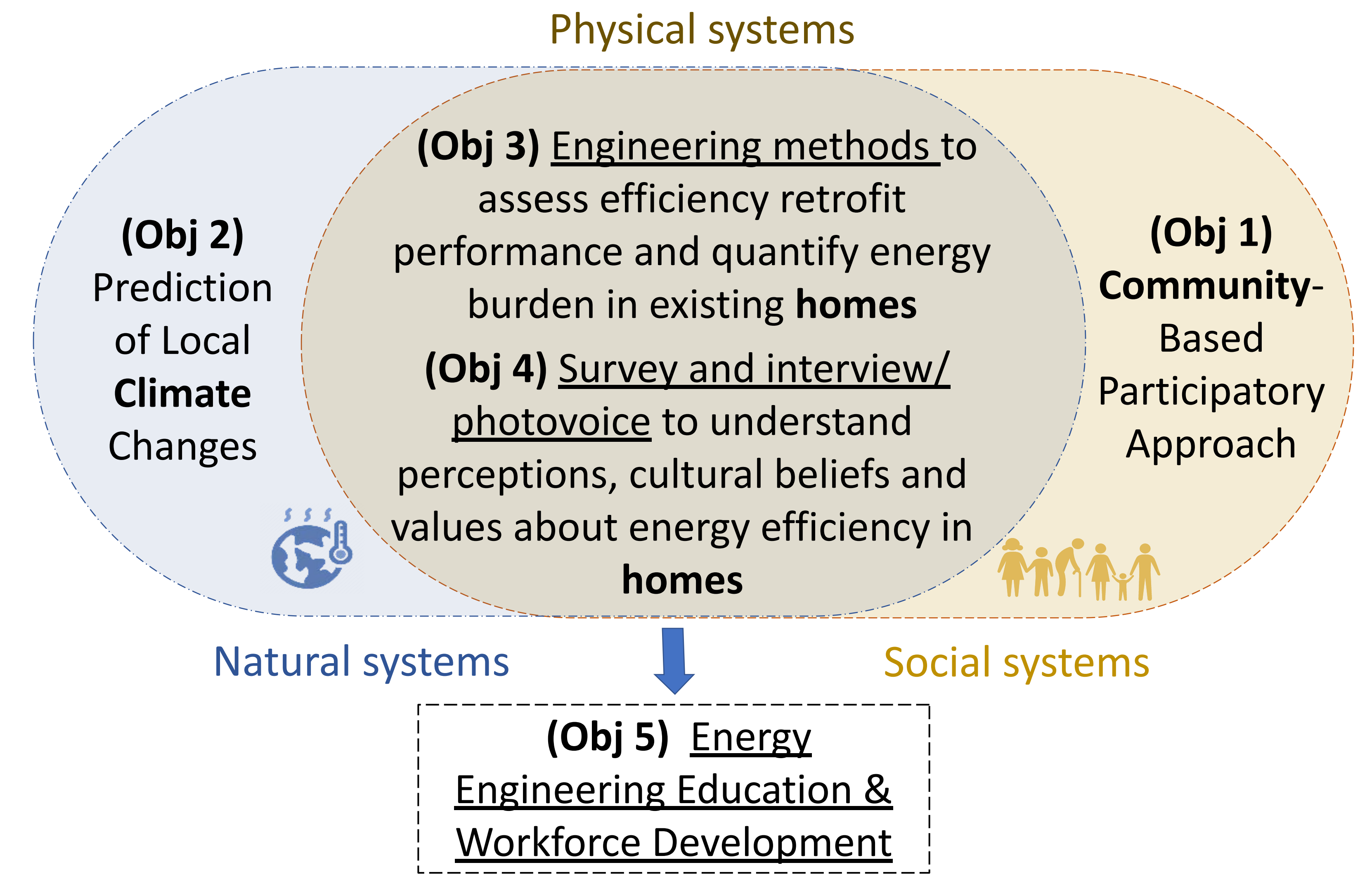
- (d) **Buildings and systems** are not designed for future climate conditions
- (e) **Permafrost thaw** is damaging housing foundations

This project aims to **analyze the effectiveness of existing energy solutions** in a changing climate, and identify ways to address concerns impacting the use and performance of current retrofits.

Prior Work

- Collaboration with Unalakleet
 - Conducted 27 housing energy assessments
 - Interviewed 53 homeowners
 - Two trips to Unalakleet
 - Provided summary of interviews/housing assessments and final report to community

Objectives



Methods

This project will use community-participatory research in **Unalakleet, Nome, and Quinhagak** to evaluate the effectiveness of **energy efficiency improvements** in these communities, evaluate how well the improvements align with homeowners values and behaviors, and identify any misalignments. The methods include:



- **Community-based participatory approach**, including a local advisory board, community meetings, surveys, and interviews.
- Arctic CORDEX **regional climate model** and previous weather data from the communities to build future climate scenarios.
- Collection of **quantitative building data**, including energy usage, indoor air quality, and geotechnical performance through assessments and long-term monitoring.
- Development and validation of a **building energy model** to quantify energy burden and energy efficiency retrofit impacts.

Expected Results

The results of this project include **assessments of housing characteristics, energy usage, and geotechnical data** for 36+ homes per community, and more detailed **long-term monitoring data** for a subset of these homes. They will also include evaluation of **existing effective solutions** and their field-validated service life as well as the identification of the **cultural values and beliefs** that drive the use or disuse of energy efficiency retrofits.

Results will also allow for the production of **validated building energy models** of homes to quantify the long-term impacts of retrofits and resulting energy burden. Findings will be compiled to create recommendations of culturally-relevant housing **energy efficiency improvement strategies** and **energy literacy programs** that consider climate change in addressing energy challenges and reducing energy burden.

Future Work

- Several field work visits per year for community collaboration, short- and long-term data collection, surveys, interviews and meetings

Acknowledgments

