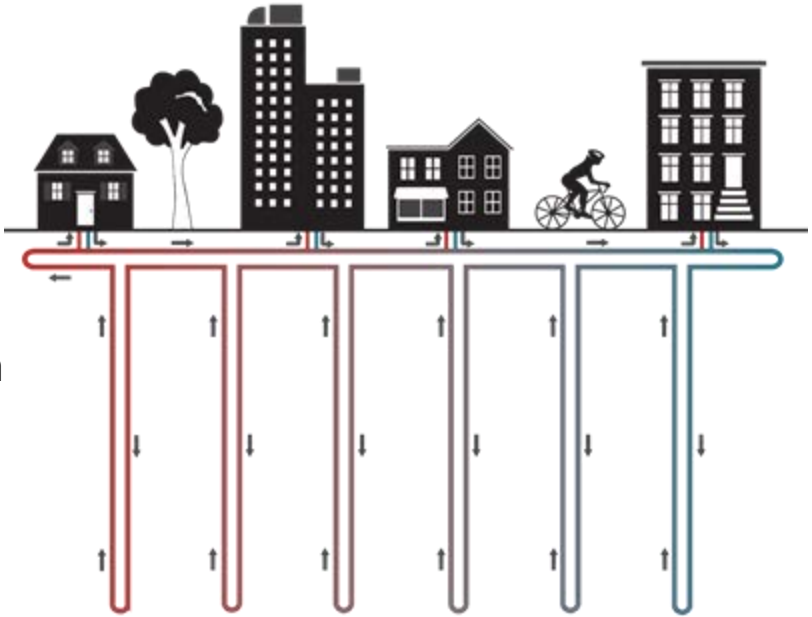
Learning from Geothermal Energy Networks

Presented by Isabel Varela
January 31, 2025

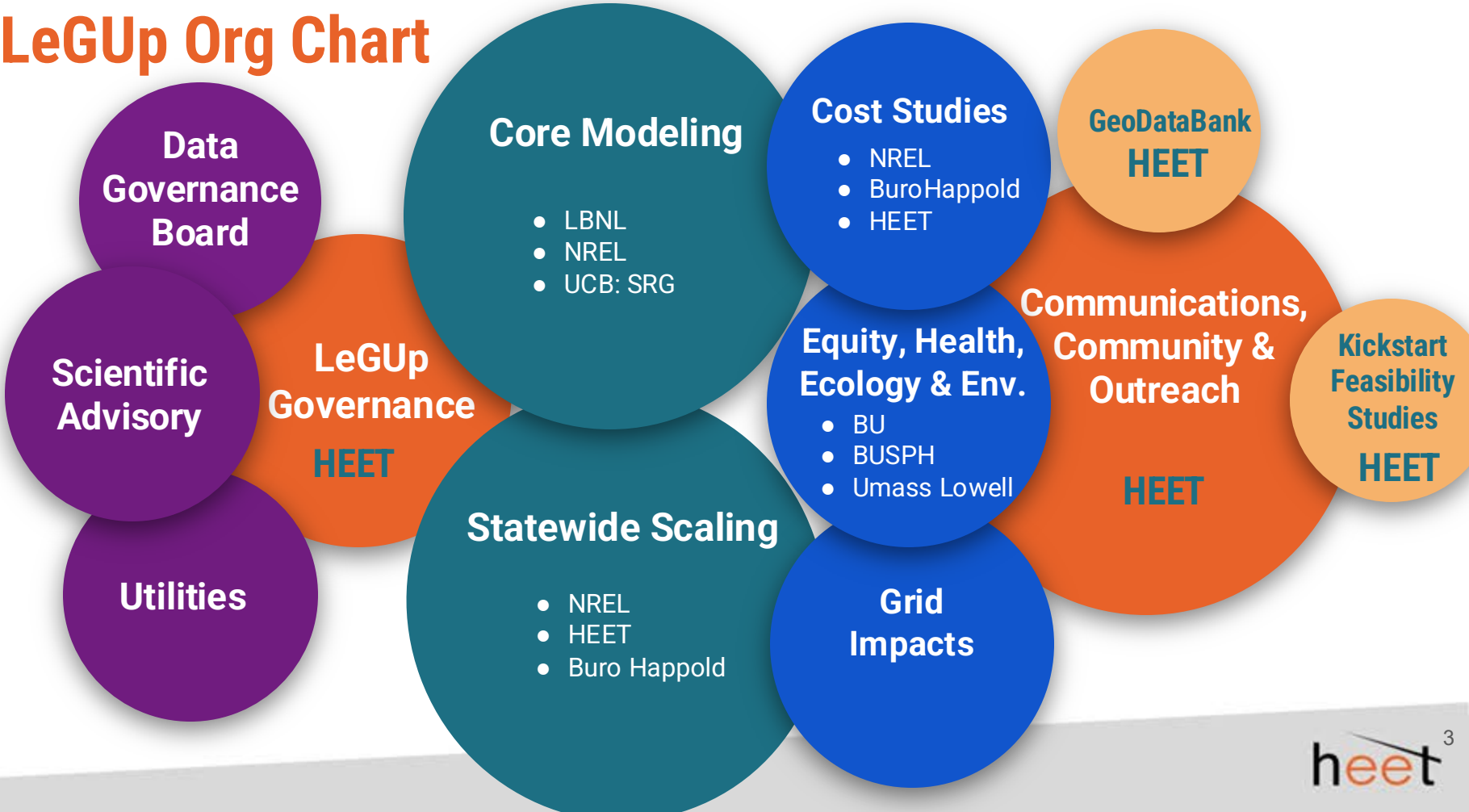
LeGUp RESEARCH PROJECT

Goals

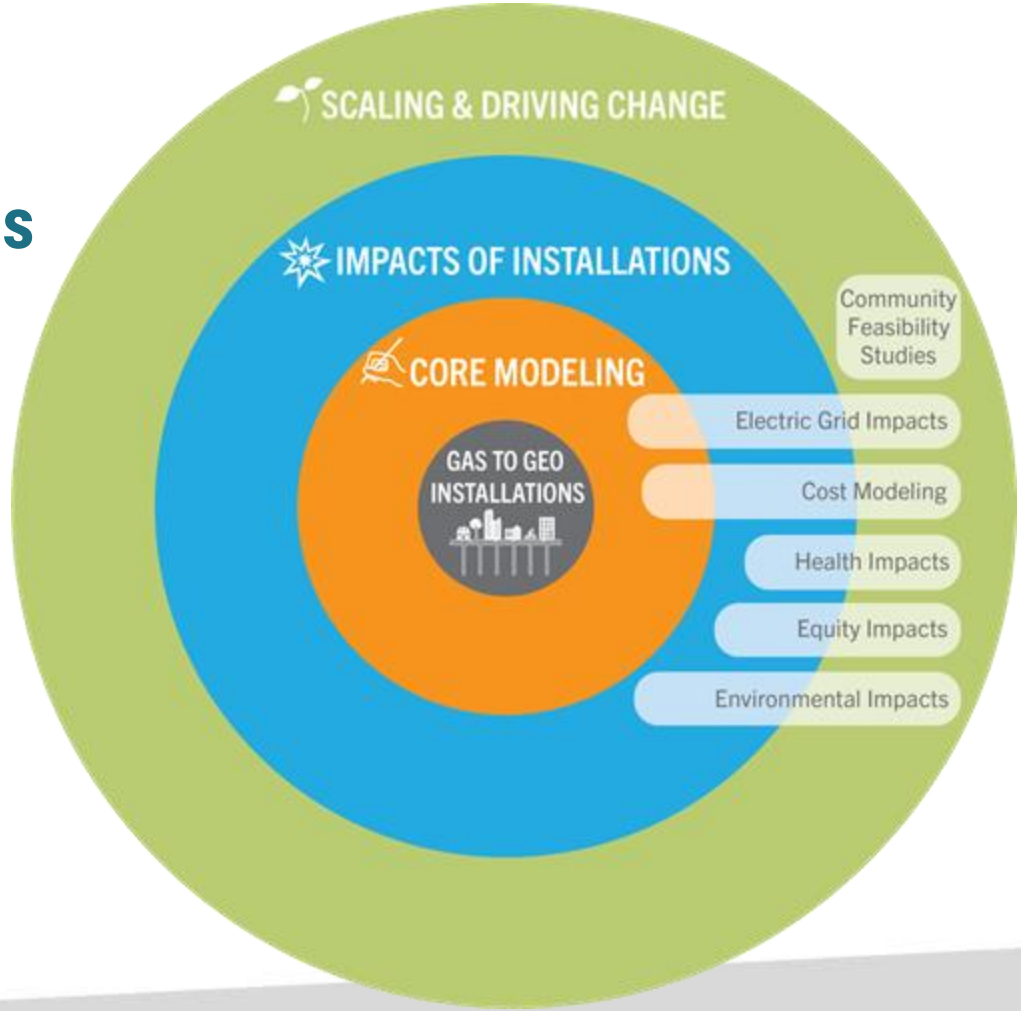
- Evaluate the potential of networked geothermal to deliver heating and cooling in Massachusetts
- Increase understanding and optimization of this technology
- Engage with and share findings with stakeholders (e.g., Department of Public Utilities, gas utilities, communities)



LeGUp Org Chart



Project Connections



DATA: PILOT INSTALLATIONS IN MA

Motivation: MA Decarb Roadmap mandates net-zero emissions by 2050, 32% of emissions from building sector (MA)

1. **Framingham** Eversource Gas
2. **Franklin Field** National Grid
3. **Framingham extension** Eversource Gas

GAS TO GEO INSTALLATIONS

Temperature Data Acquisition

Objective: Install fiber in 15 boreholes across the whole system connected to an interrogator device on each borefield

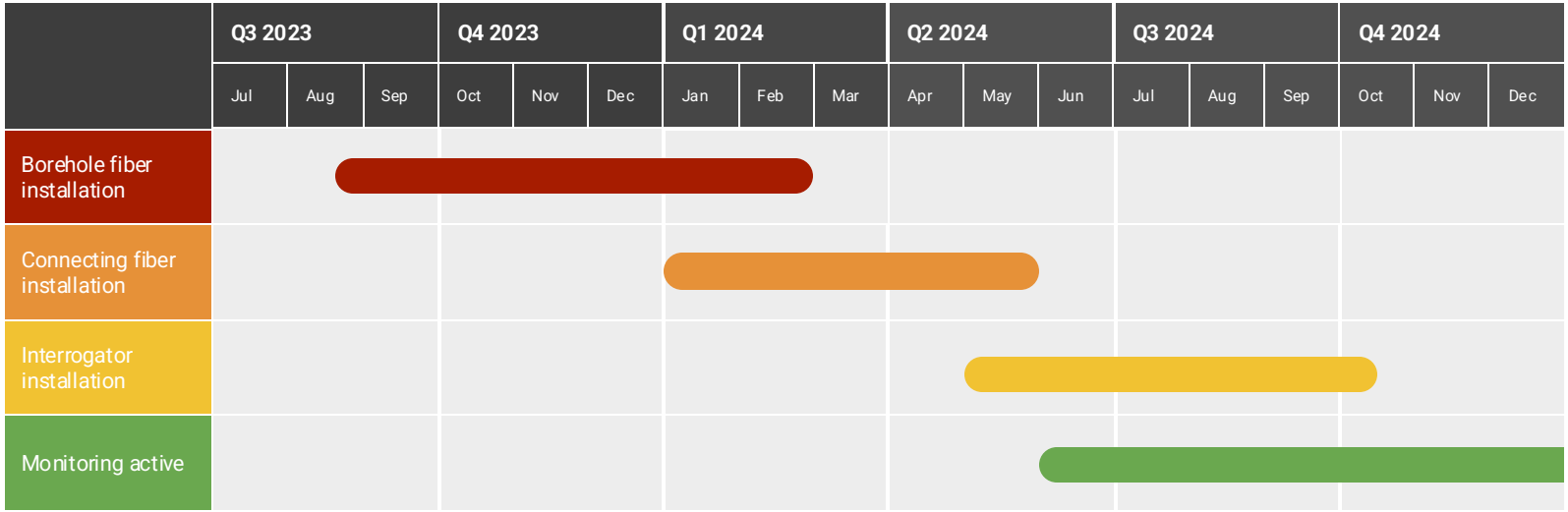
Status: All 15 boreholes instrumented. Permanent interrogator installed at Farley. HEET working with Senecal for installation of two other interrogators

Team

Soga lab: Jiahui Yang, Kecheng Chen, Yaobin Yang, and Sumeet Sinha

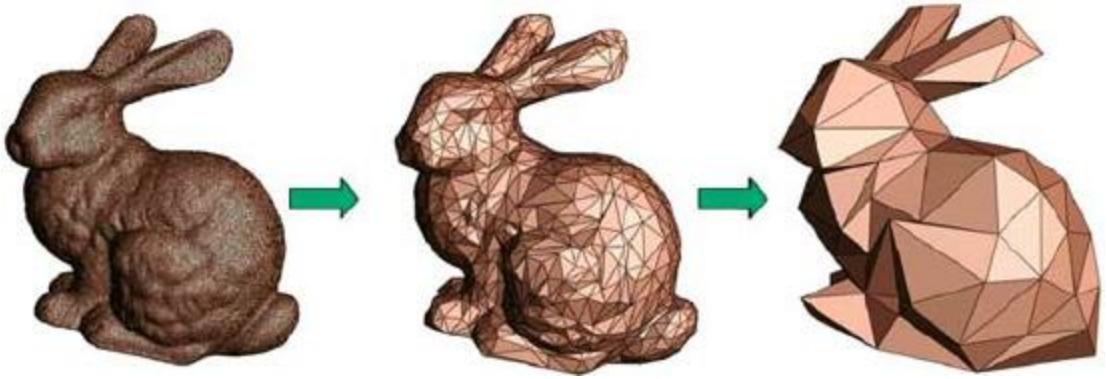
HEET: Eric Juma, Victor Oyeleke, and Isabel Varela

Working closely with Eversource, RH White, Celsius, Berkeley, and Midwest Geo



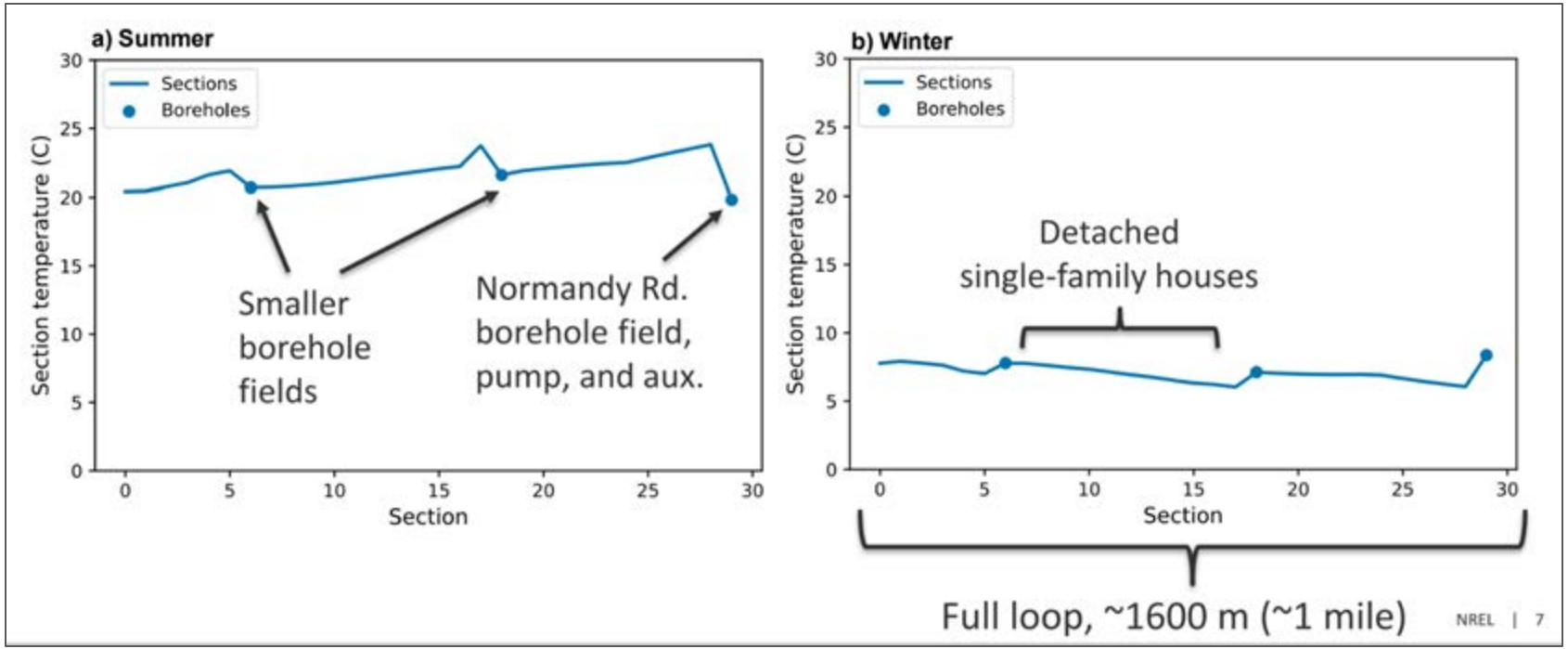
DEVELOP CORE MODELS

Develop **Full Physics** and **Reduced Order** models using data from the first few installations:



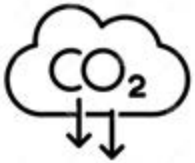
CORE MODELING

DEVELOP CORE MODELS: Reduced Order Model



MODEL AND MONITOR IMPACT OF INSTALLATIONS

Develop data-driven models and test predictions:



Emissions

Grid

Costs

Ecology

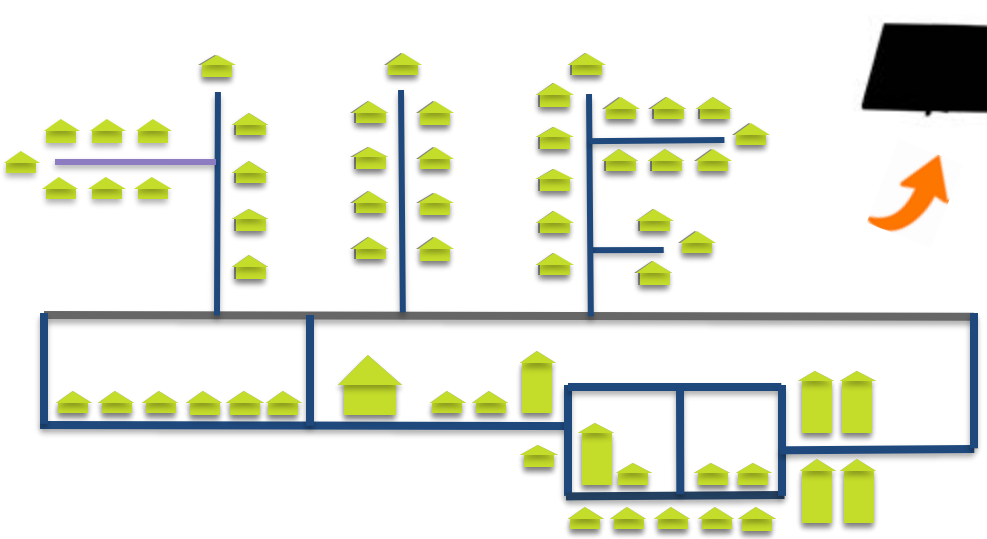
Health

Equity

IMPACT OF INSTALLATIONS

Regional Assessment

- Develop scaling projections from the Core Models
- Measure and maximize impact



SCALING AND DRIVING CHANGE

Databank for Geothermal Networks

Enable quantitative comparison

Contribute to prediction models

Inform planning & optimization of future systems

Record costs related to heating and cooling

Identify costs and energy use by stages

Catalyze & derisk the adoption of these networks

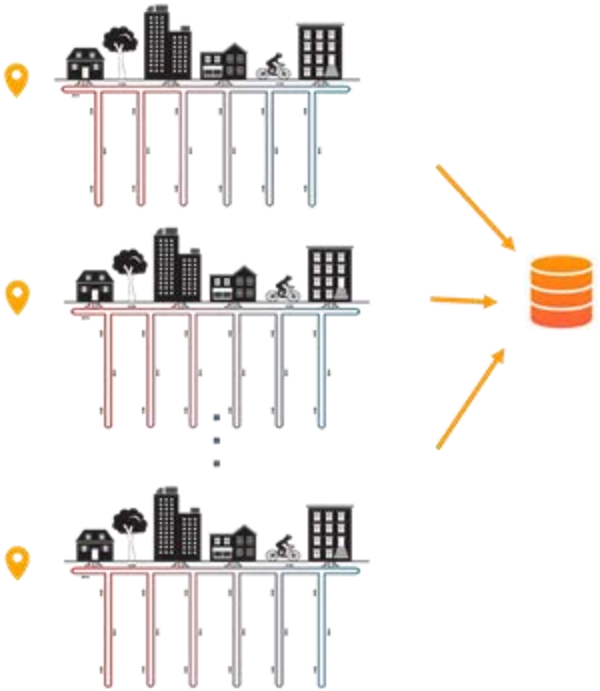
Demonstrate impacts on emissions, environment and human health

Support development of data-driven legislation & regulation

Databank for Geothermal Networks

- What? A **public data bank** of geothermal network installations
- Why? to **inform and facilitate** future developments, enabling societal-scale building decarbonization
- How? Interface with HEET website. Database saved in perpetuity in **Harvard Dataverse**. Open access.

Databank for Geothermal Networks



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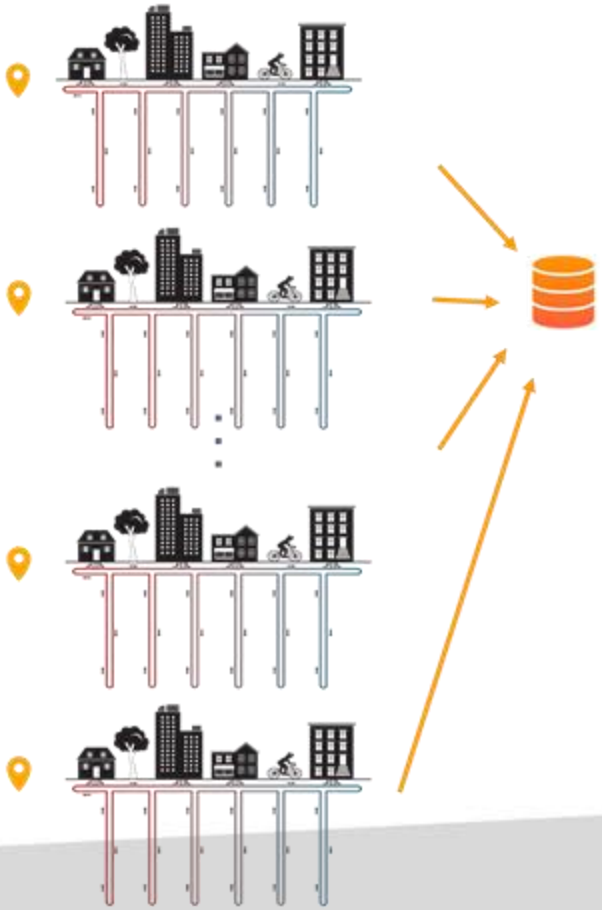

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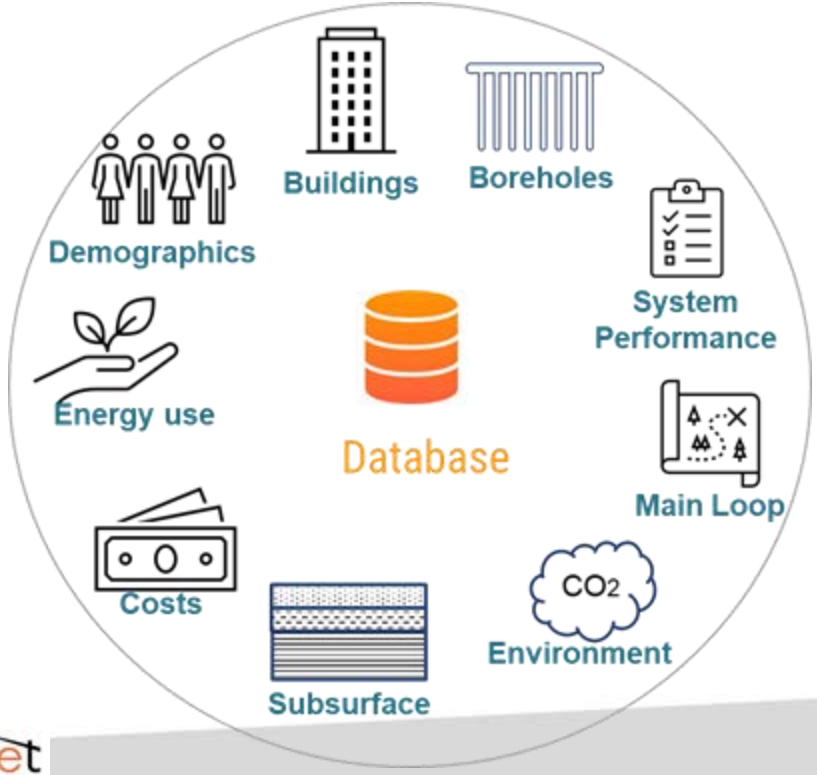
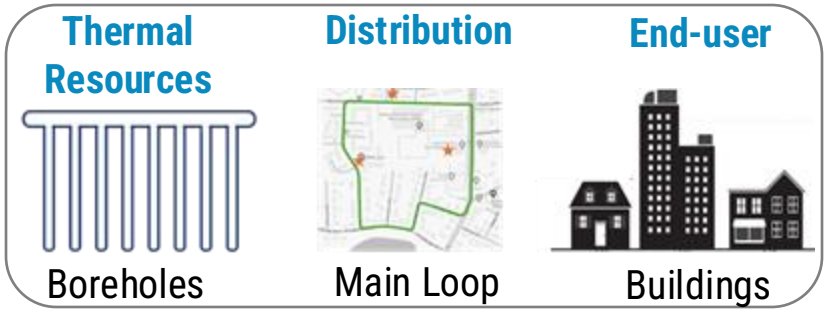
Databank for Geothermal Networks

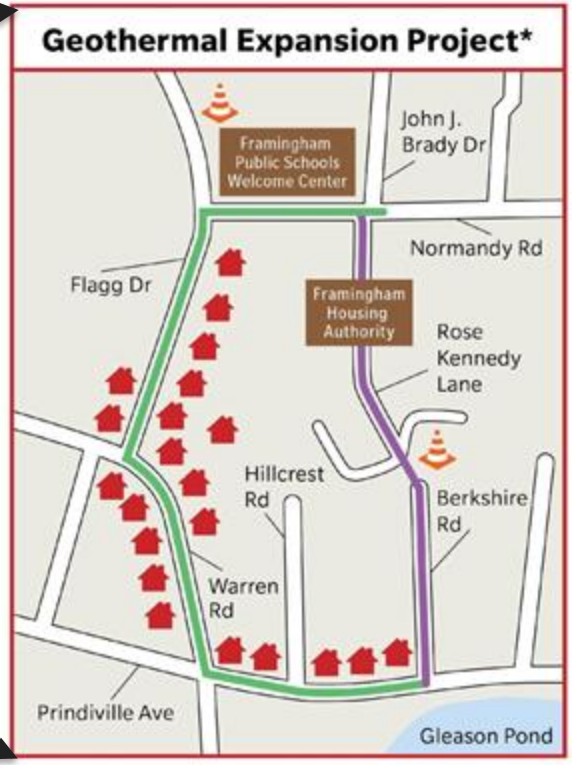
Categories



Stages



DOE Community Geothermal Grant



Proposed route

Existing Geothermal

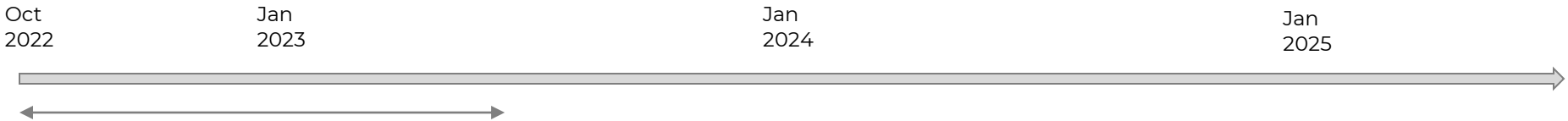
Borefield drilling sites

Potential residential customers (representation only)

**Project is in the very preliminary stages and whether it goes forward will depend on the interest level of and support of the residents along the route.*

Questions & Discussion

Project Accomplishments & Timeline



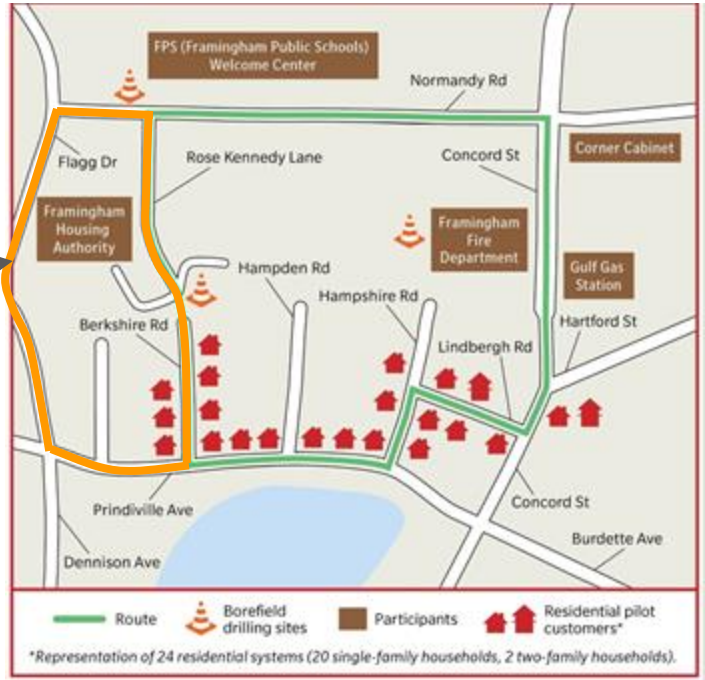
- Teams setup
- Test boreholes drilled
- TRT Framingham and Lowell
- Construction start at Framingham

- **DFOS** installs completed at Framingham
- NREL **reduced order model** & publication
- LBNL ground water flow and full physics model
- Soga Research Lab **TRT publication**
- BUSPH **equity dashboards** live
- **Kickstart** program launched
- DEP **depth to bedrock maps**
- **Framingham** construction finished, commissioning underway
- **Lowell design** completed with review
- **Franklin Field design** RFP being designed
- **Framingham 2nd loop design** completed

DOE Community Geothermal Grant

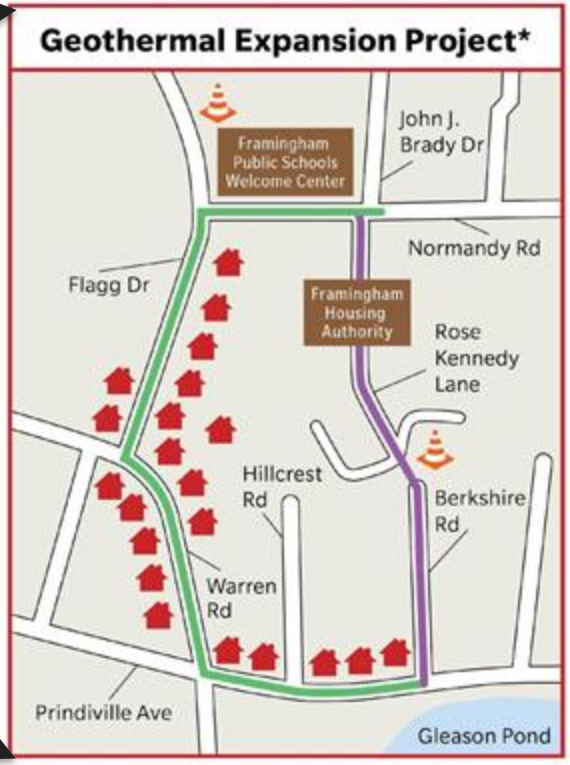
Phase 1: Design, grant awarded

- **Announcement:** April 25, 2023, DOE awards HEET and partners a Community Geothermal Grant. Grant starts Oct 1.
- **Project uniqueness:** First extension to an existing geothermal network run by a utility
- **Planned Project:** A utility-managed geothermal network in the City of Framingham to meet 100% of the heating and cooling needs of the buildings connected to the system.
- **Grant components**
  a. Design of system (current status: 60% design completed)
  b. Community Engagement (current status: completed for this BP)
  c. Workforce development (current status: tutorial completion today!)



Phase 2: Construction, application for DOE grant by Sept 30 2024

DOE Community Geothermal Grant



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RES.ENV 007 Geothermal Energy Networks (GENs): Transforming our Thermal Energy System

IAP 2025