Agent-Based Simulation of Transition Scenarios for the Regional Heating and Energy Transformation

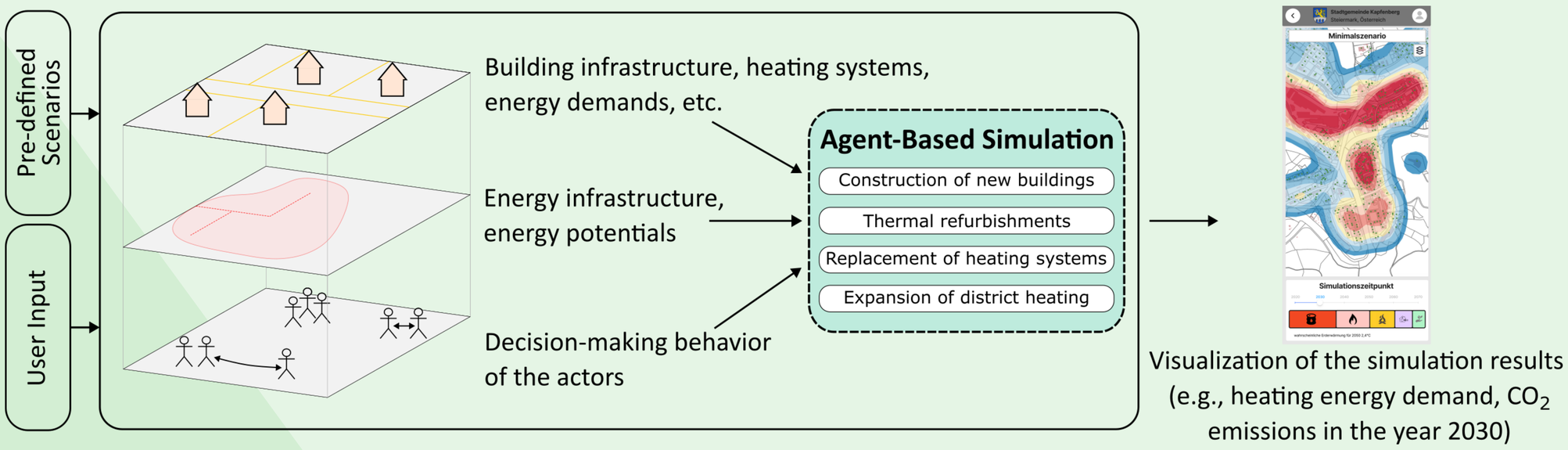
- ABM4EnergyTransition -

Background

Motivation for modeling the Styrian heat and energy transition
Our energy system is undergoing rapid change. New technologies and opportunities such as electromobility, digitization or energy communities are entering the market, which must be reconciled with societal demands for greater sustainability and political commitments such as the Austrian heating strategy. This poses a high level of complexity for decision-makers in politics, energy supply and business. Certain modeling approaches can support these actors in their decision-making process.

Consideration of the technical, spatial and social dimensions in planning processes
The behaviors and decision-making patterns of central actors within the energy system (e.g., households) are, if at all, hardly considered in current simulations. Consequently, the presented project will integrate technical and spatial data (buildings, energy potentials, etc.), as well as the decision-making behavior of these actors into an agent-based model (ABM). This will expand existing planning approaches and thus achieve a better representation of reality, as more complex interactions can be modeled.

Methodology



Concept

Methodologically, an agent-based simulation model is used to analyze and evaluate transition scenarios for the regional heating and energy transformation

Processes that are simulated in the ABM are, for example, heating system replacements, thermal refurbishments or the construction of new buildings

Corresponding simulation results (e.g., development of the heating energy demand in a specific region up to the year 2050) can be visualized and analyzed in a web application

Data Basis

Spatial data to describe the energy system
Buildings (incl. heating systems, heating fuels, energy demands), energy infrastructure, local energy potentials, etc.

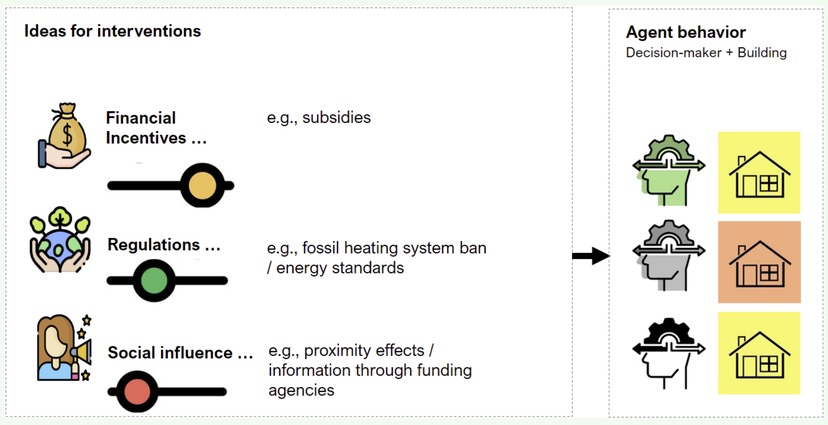
Parameters for describing the decision-making behavior of agents
Homeowners' decision-making behavior is influenced, for example, by personal factors, building characteristics or social influences → this was specified through an online survey (primary data collection) to which 30.000 Styrian households were invited

Decision-Making Behavior of Agents

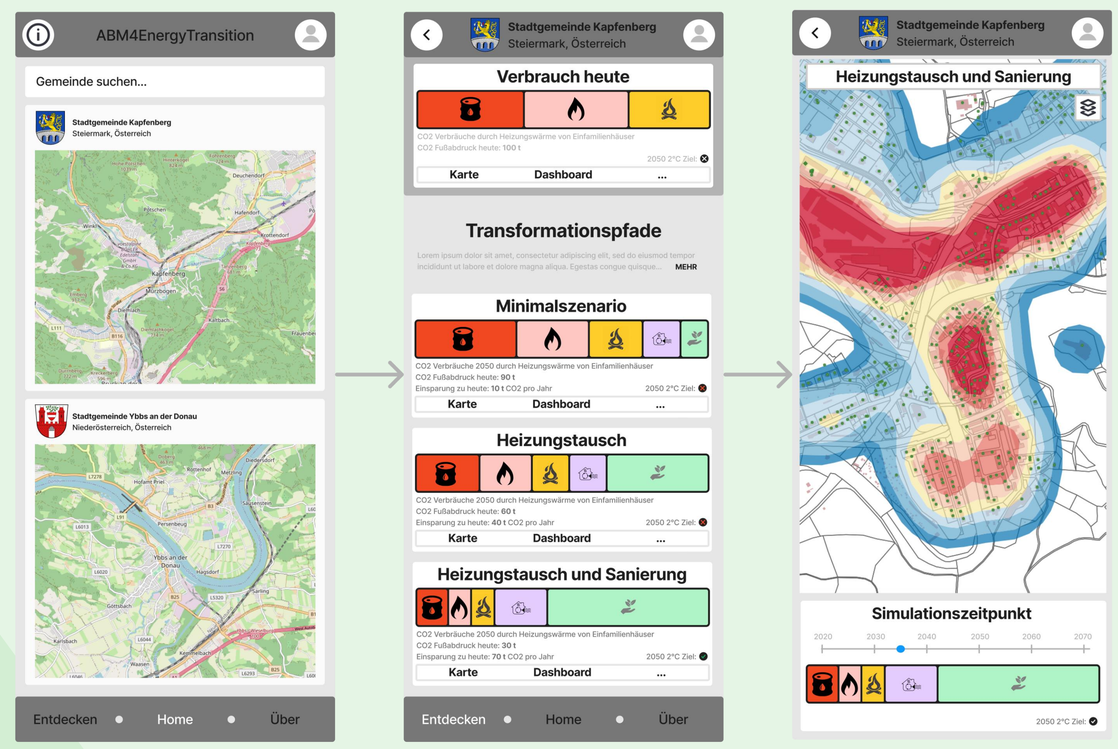
By including the decision-making behavior of agents into the ABM, a more realistic simulation can be obtained

Through a statistical analysis of the survey results, household attributes can be derived, which are then assigned to the decision-making agents in the simulation

Public policies, such as financial incentives or certain regulations, influence the behavior of the agents in the simulation



Wireframes of the Application



Goals of the Project

Prototypical **web application with a map display of the building and energy infrastructure** including a dashboard

Planning tool for possible energy policy and/or technical interventions

Impact assessment of public policies on the achievement of climate and energy goals

Visualization and analysis of the simulation results (energy and ecological balance, technology and energy carrier mix in variable spatial and temporal granularity, etc.)

More information about the project:
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