



# An agent-based model of local energy autonomy in Germany

Huijie Li<sup>a</sup>, Uwe Pfenning<sup>b</sup>

<sup>a</sup> Department of Technology and Environmental Sociology,  
University of Stuttgart

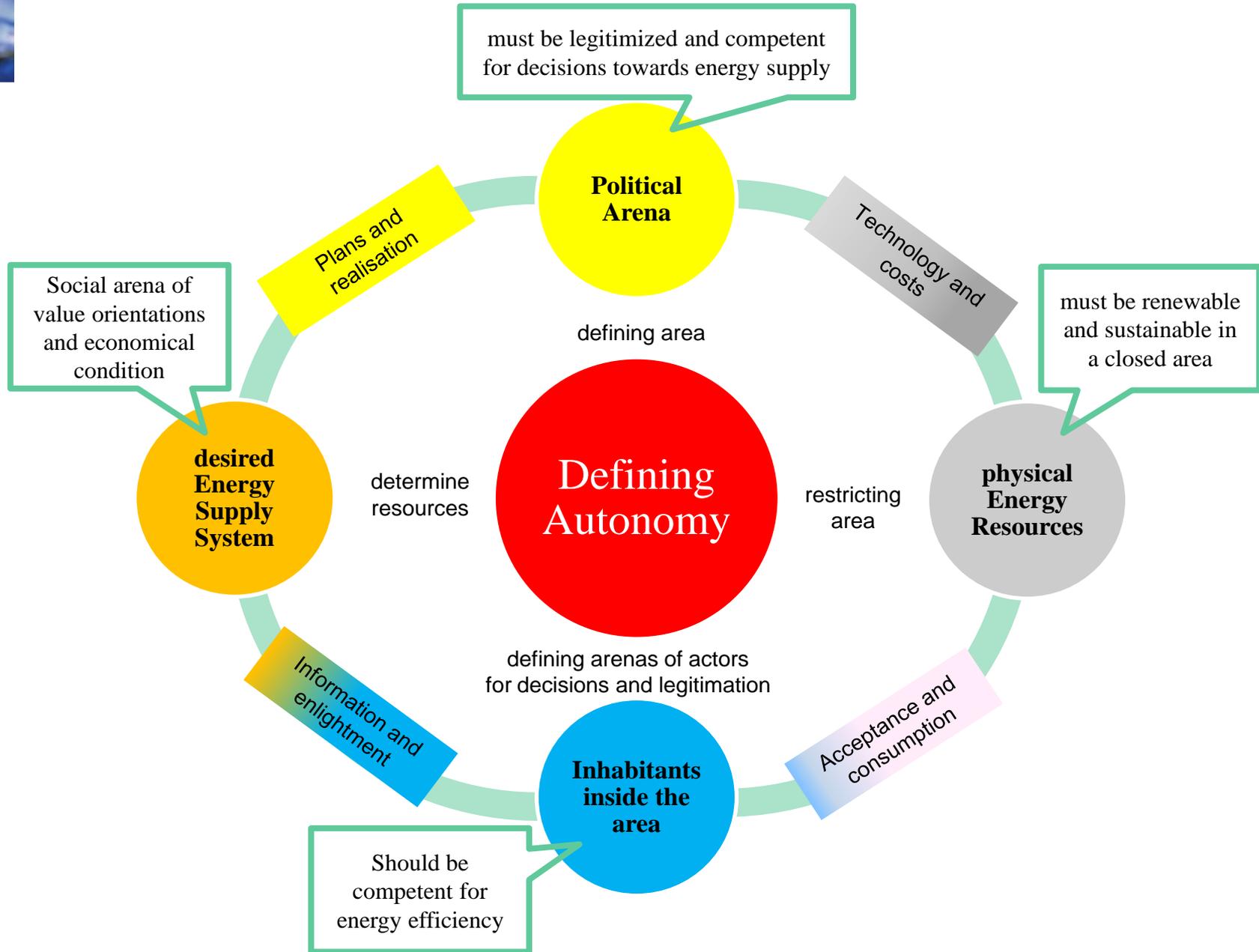
<sup>b</sup> German Aerospace Center (DLR), Institute of Technical  
Thermodynamics, Department of Systems Analysis and  
Technology Assessment



# Energy Autonomy

**„Energy Autonomy“ is a term according to ....**

- a) the political aim „autonomy“
  - b) combined with technical options for an energy supply system
  - c) focus on a defined and closed territorial area of energy resources for an also defined population and social networks inside
  - d) to satisfy all requests and needs of inhabitants inside this area for energy consumption
- i.e. Energy Autonomy is a social defined construct, based on physical resources and including conventions, restrictions and legitimation. Energy Autonomy is therefore a process, dealing with decisions and conditions in social arenas inside a closed area.



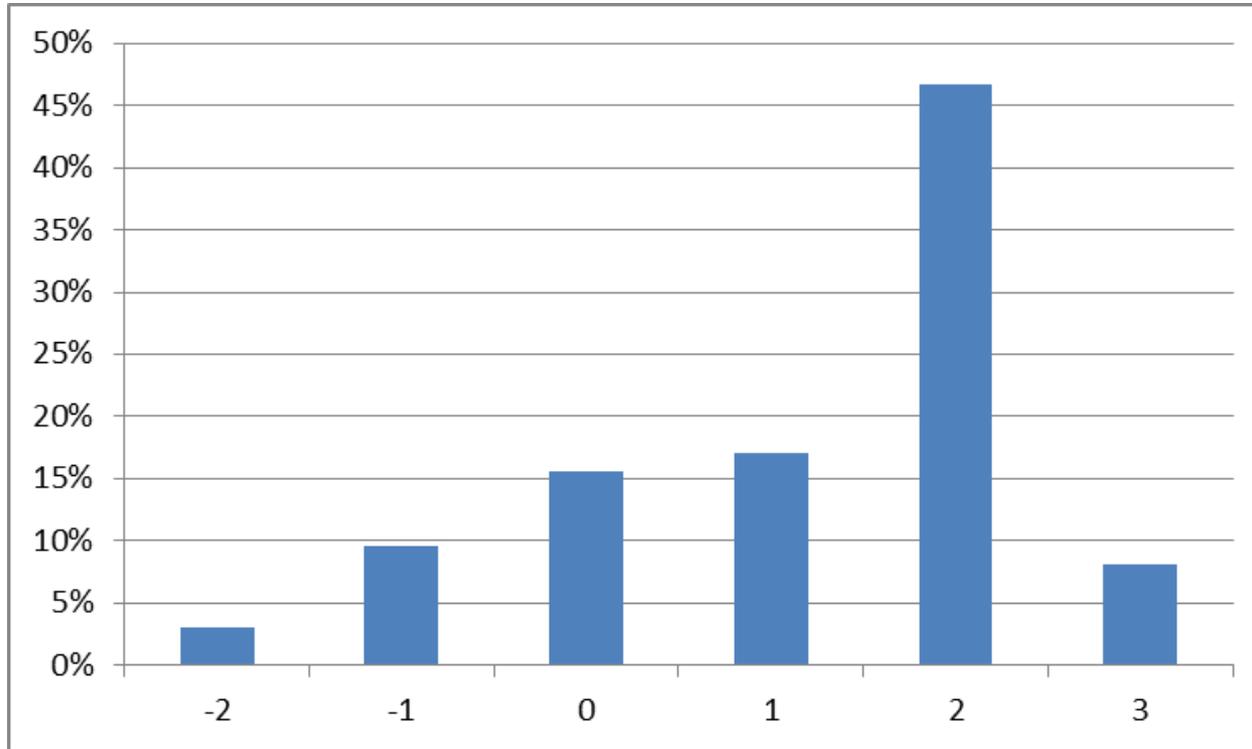


# Biogas power plant project in Hausen, Germany

- Pilot-Case-Study in 2004-2006 for implementation of a local energy supply system based on interests of involved people
- Citizen Survey for attitudes and acceptance of participation
- Citizen Panel for acceptance of technologies  
Deliberation Process of bringing lay people in communication with experts and local stakeholder
- Reflection of results by citizen panel with the public
- Establishing civic culture for ESS



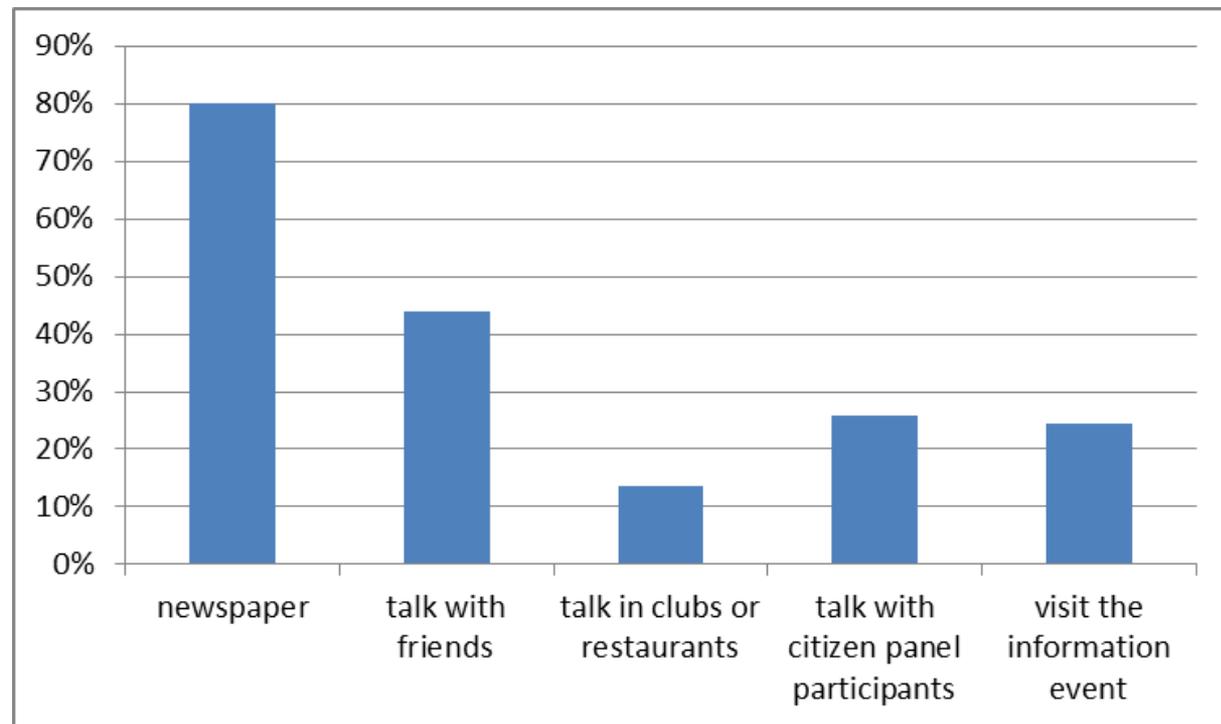
# Legitimation of participation





# Social and information networks

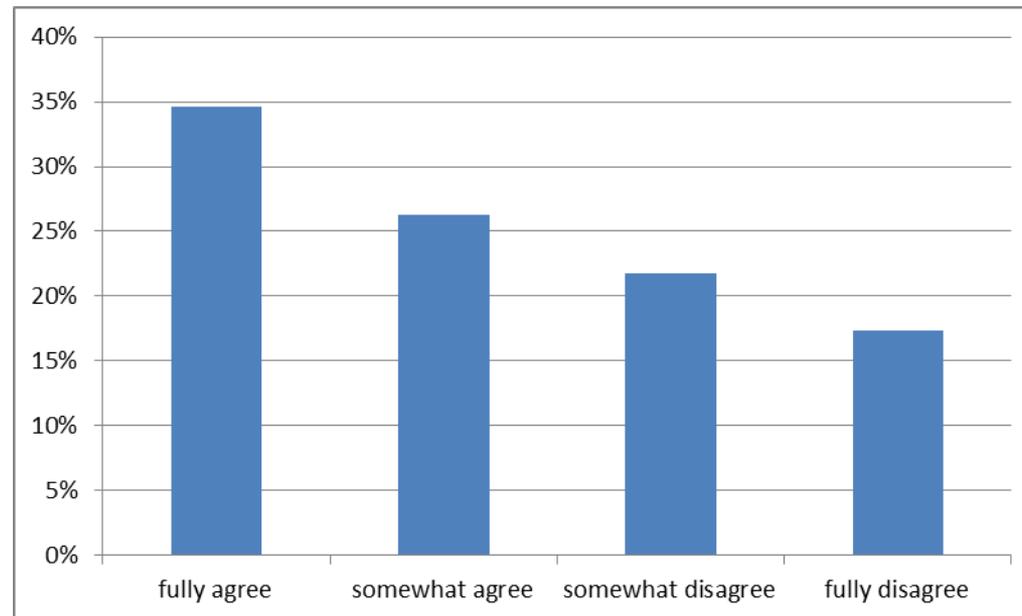
- 39.2% know a lot, 53.8% know some, 7% know nothing
- Information source:





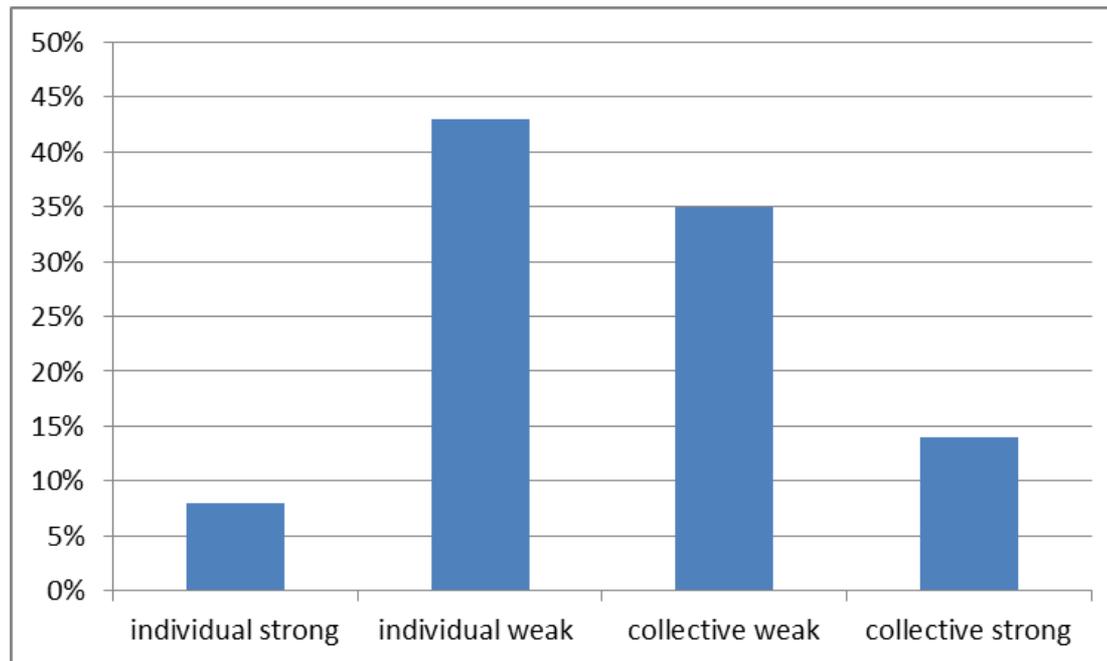
# Biogas power plant project in Hausen, Germany

- i1: Burning food crops violates my values: nourishments should not be burned.



## i2: Individual heating vs. Collective heating

- Preference of individual independent system
- I can make my individual heating much more environmental-friendly than collective heating.
- Collective heating is usually more expensive than my own heating.





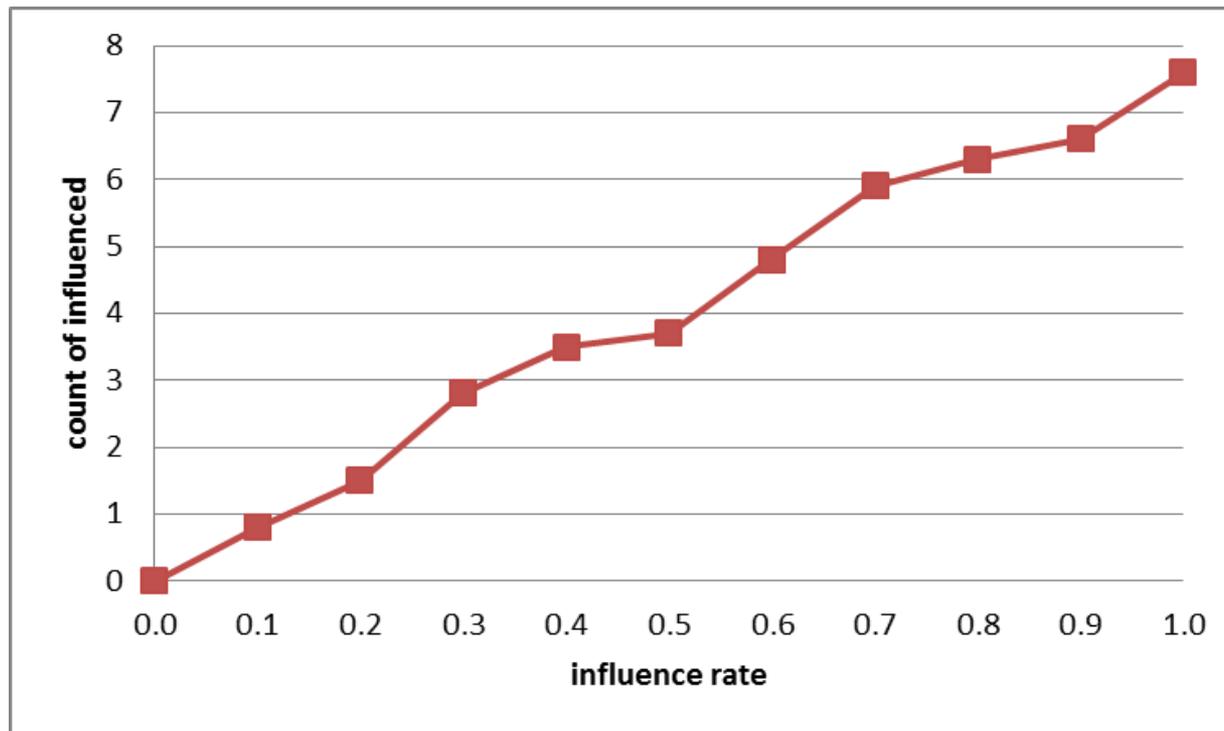
# Agent-based modelling

- 199 agents
- „Small-World“ network
- Initial setting:
  - ~36% already connected to district heating
  - 20 out of 199 show willingness to be connected



# Agent-based modelling

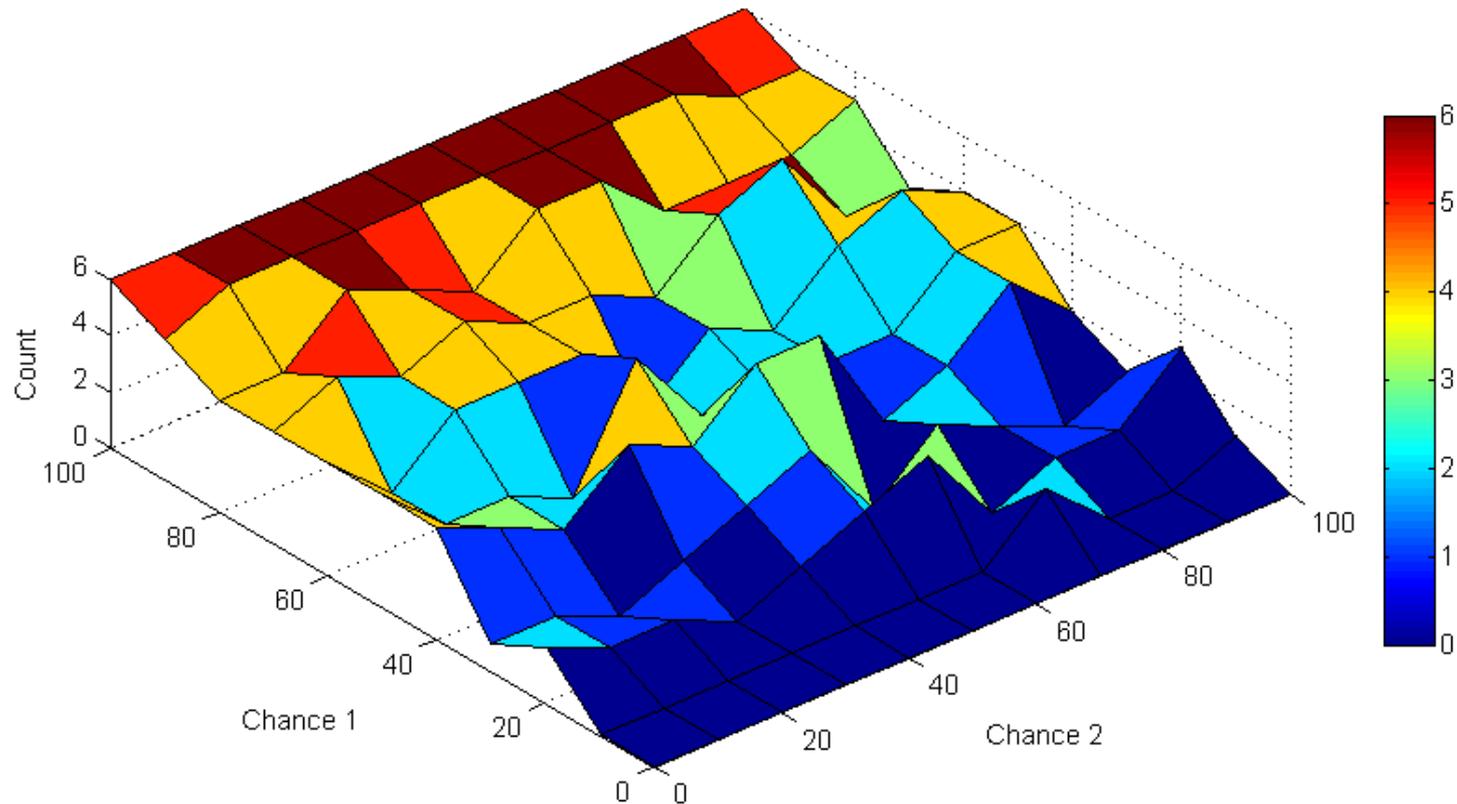
- Opinion Leaders of  $i1$  influence: 18





# Opinion Leaders of i2 negative influence:

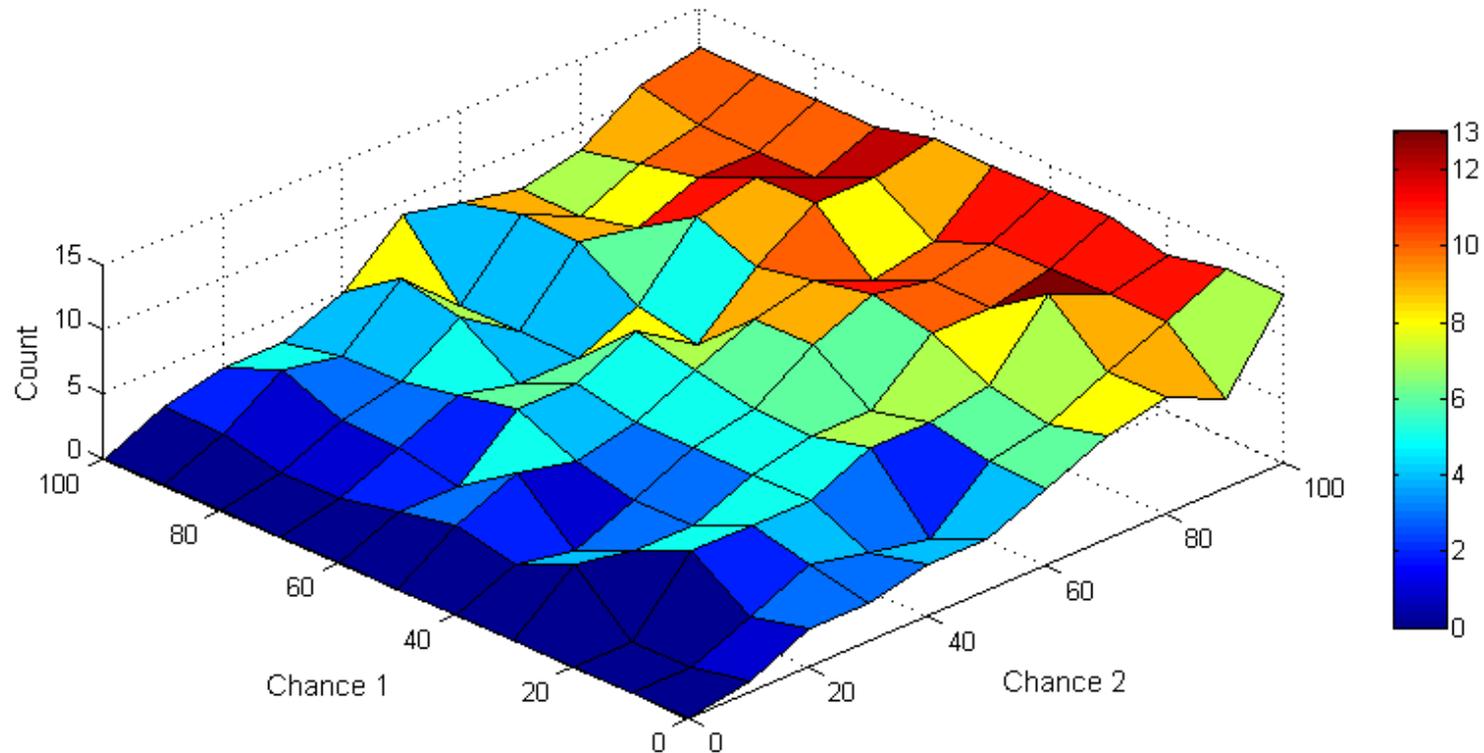
**4 (individual, influence-chance1)** vs. 14 (collective, influence-chance2)





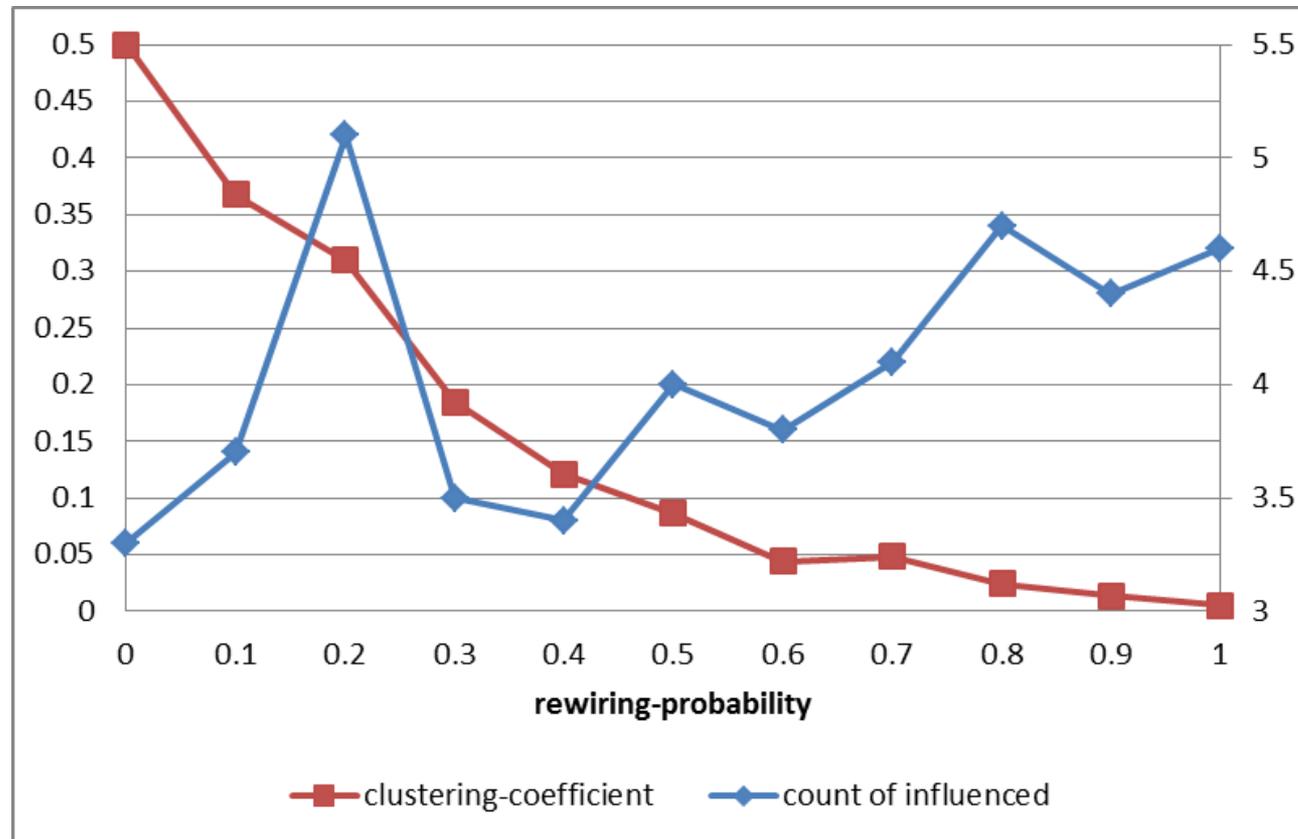
## Opinion Leaders of i2 positive influence:

4 (individual, influence-chance1) vs. **14 (collective, influence-chance2)**



# Network influence

positive attitude change





## Settings

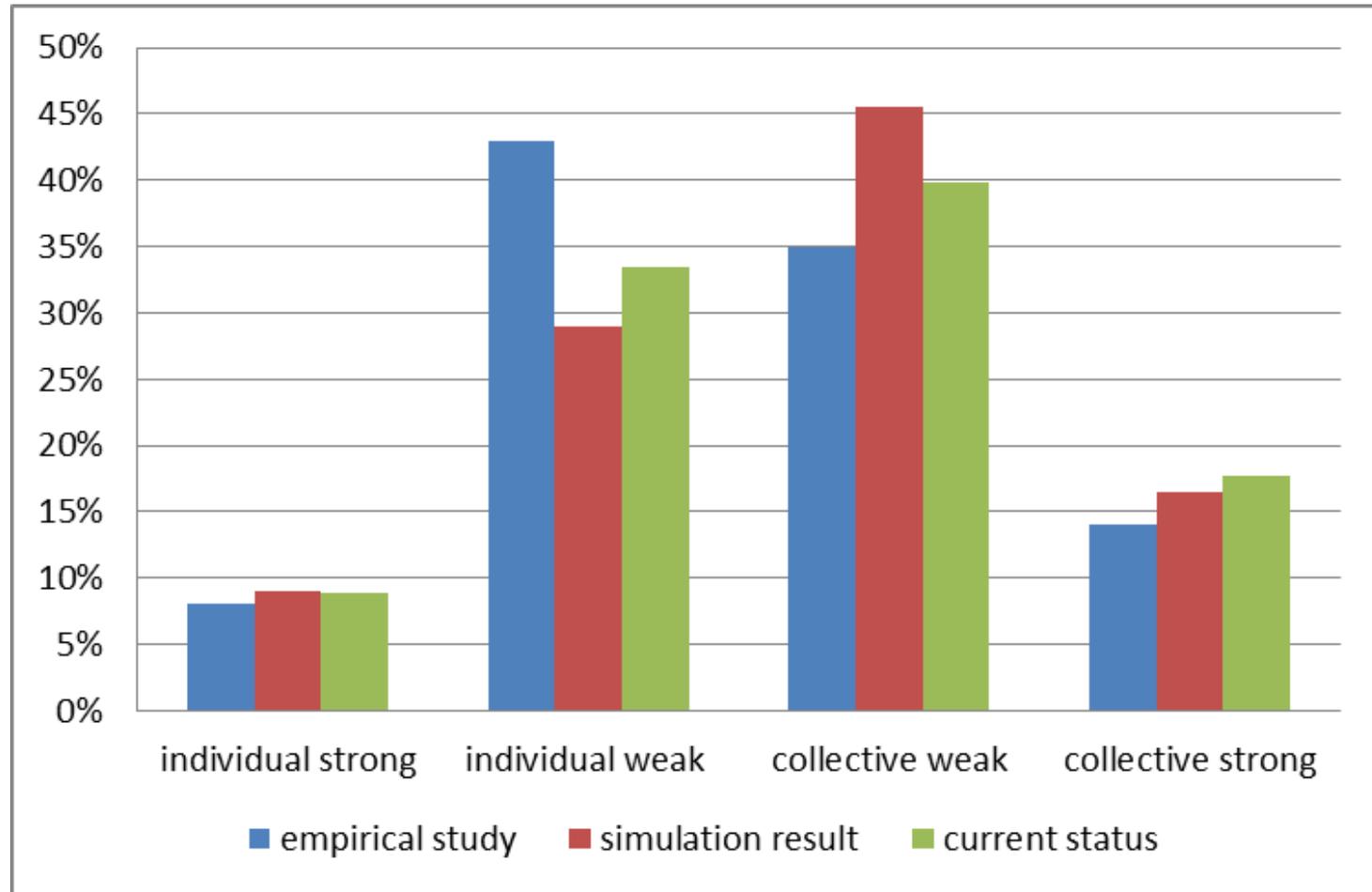
- 72 already connected to district heating
- 20 out of 199 show willingness to be connected
- Rewiring probability = 0.2
- influence-chance1=0.5; influence-chance2=0.5

## Simulation Results

- 49 potential connections



# Individual heating vs. Collective heating





# Conclusion: challenges and risks

- Economic risks and costs
- Technical risks-over capacity
  - acceptance of collective systems
- ? acceptance by participation: Legitimation of small-sized groups
- ? acceptance by use
- Emerging issues during the participation process



**Thank you very much for your attention!**