



## System complexity as key determinant in achieving efficacious policy transposition and implementation

The case of low carbon and energy efficient technology adoption for mobility and heating demand in Austrian households

Claudia Fruhmann\*, Andreas Tuerk\*, Veronika Kulmer\*, Sebastian Seebauer\*\*

\* LIFE – Centre for Climate, Energy and Society, JOANNEUM RESEARCH Forschungsgesellschaft mbH

\*\* Wegener Center for Climate and Global Change, University of Graz

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## Introduction

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- **Increasing EE** has become one of the **main targets** in today's energy and environmental policy making
- In the EU **private households** account for **~25% of final energy consumption** (2014, Eurostat)
- **EE policies** that aim to reduce energy consumption of **private households** fall within the **responsibility of national governments**
- The **adoption of EE technologies in households** often falls below **expectations**
- What **keeps policy instruments** from achieving its **desired performance?**

# Research aim & study area

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## Research aim:

- Understanding causes, barriers and effects
- To give recommendations for improvements in future policy design

Energy efficient technology adoption in Austrian households



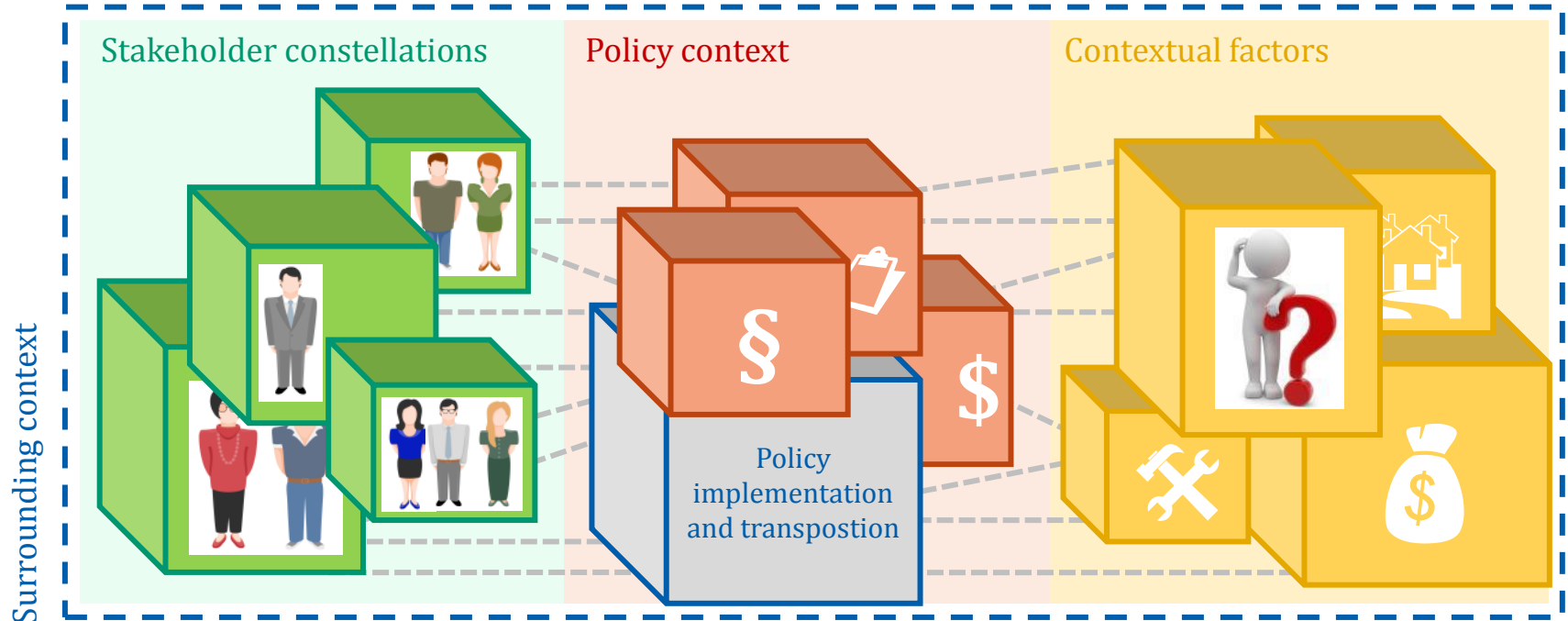
Mobility



Heating demand

# System complexity

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## Policy performance

expected, theory-based performance  $\neq$  actual performance

# Fuzzy cognitive mapping

## Methodological approach

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- **Describe and display the operation of complex systems** in terms of **concepts** (system elements) and **arrows** (relationships between them)
- Used to **analyse the structure** & to **identify most important elements** of a system

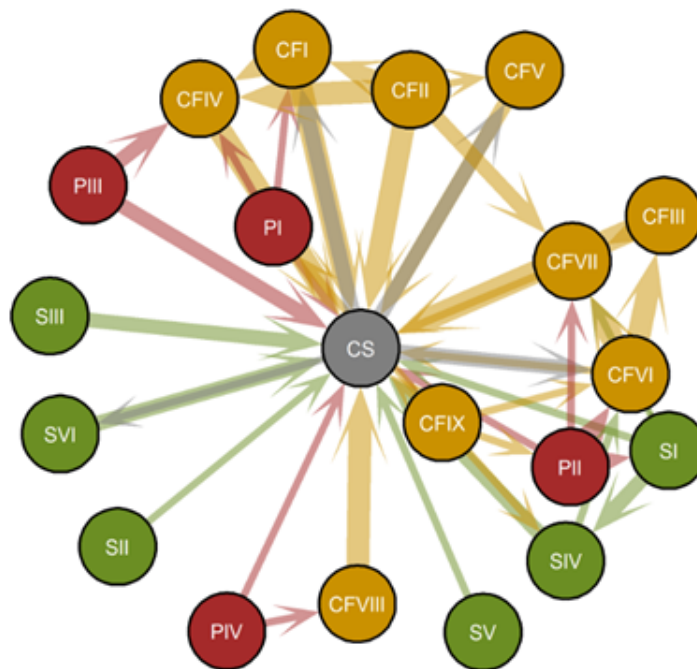
### Advantages:

- Mainly based upon **expert's knowledge** – interviews with key stakeholders
- Not only **qualitative** but also **quantitative description** of system correlations (relationships between system elements are assigned with fuzzy quantitative weights)
- **Applied widely and proven to be useful** in environmental policy making (Isaac et al. 2009; Papageorgiou et al. 2009; Rajaram & Das 2010; Kafetzis et al. 2010, Özesmi & Özesmi 2004)

# Mobility (e-cars) in Austria

## Results

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CS ... Central stakeholder  
S ... Stakeholder  
PI ... Policy instrument  
CF ... Contextual factor

Identifier	System elements
CS	Households – purchase of e-car
PI	Subsidy – purchase of e-car
PII	Subsidy – charging infrastructure
PIII	Tax exemptions
PIV	Surtax on fuel prices
SI	Public instit. / municip. / business
SII	Media
SIII	Social network
SIV	Pioneering projects
SV	Automobile clubs
SVI	Vehicle retailer
CFI	Investment costs
CFII	Level of e-car technology development
CFIII	Possibility: charging at home
CFIV	Uncertainty of future benefits
CFV	Supply of different e-car models
CFVI	Existing infrastructure
CFVII	Required planning of charging
CFVIII	Fuel price
CFIX	Differing federal and regional political priorities

# Mobility (e-cars) in Austria

## Results

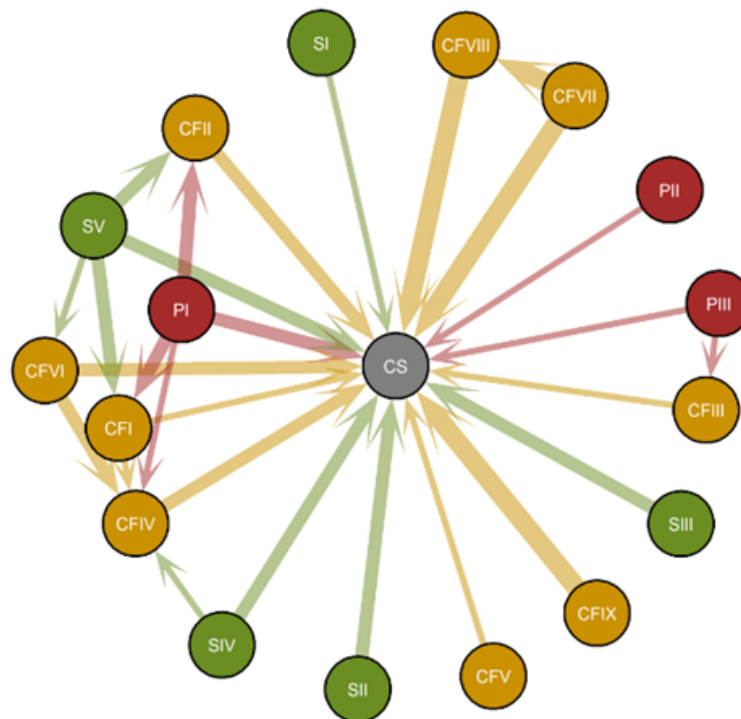
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- Subsidy programmes / other policy instruments = **insufficient in stimulating investment decisions**
- Overall **negative impact** of **mainly contextual factors** nullifies political attempts; negative impacts are:
  - mainly **financial driven** (e.g. high investment costs, uncertainty of future benefits, low fuel prices)
  - determined by **charging constraints** (limited possibilities to charge e-cars at home) and **uncertainties as to e-car technology development**
- **Stakeholder groups** would have the **potential to raise households awareness** – potential currently not fully utilized

# Heating demand (building insulation & heating systems based on RES) in Austria

## Results

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CS ... Central stakeholder  
S ... Stakeholder  
PI ... Policy instrument  
CF ... Contextual factor

Identifier	System elements
CS	Households – investment building insulation/ heating systems based on RES
PI	Subsidy – building insulation / heating systems based on RES
PII	Building regulation
PIII	Surtax on fuel prices
SI	Media
SII	Social network
SIII	Pioneering projects
SIV	Actors supporting project realization
SV	Actors implementing measures
CFI	Investment costs
CFII	Price discrimination
CFIII	Fuel price
CFIV	Uncertainty of future benefits
CFV	Climatic conditions
CFVI	Lifetime of old components
CFVII	Coordination national government – federal states
CFVIII	Dedication of available funding
CFIX	Complex application procedures



# Heating demand (building insulation & heating systems based on RES) in Austria

## Results

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- Main issue: **implementation barriers and inefficiencies of subsidy programmes** (NOT policy framework)
  - Coordination between national governments and federal states
  - Dedication of funding volume
  - Complex application procedures
- Reinforced by **negative impacts** of other system elements (**mainly contextual factors**), those negative impacts are:
  - Mainly **financial driven** (e.g. high investment costs, high uncertainty of future benefits, price discrimination, low fuel prices)
- **Stakeholder groups** would have the **potential to raise households awareness** – potential currently not fully utilized

# Case of Austria

## Conclusions

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### ■ **Mobility**

- If financial incentives should work, **e-car technology needs to be developed further**
- In the meanwhile: **focus on other policy solutions** e.g. to incentive those actors that could easier find business cases and at the same time be pioneering example for households; promote e-car sharing
- **Lack of charging opportunities** should be addressed in policy design
- **Learn from other countries** e.g. more targeted taxes

### ■ **Heating demand**

- **Better balance in the policy mix** could overcome implementation barriers and inefficiencies of subsidy programmes
- **Application procedures** should be **simplified**
- **Learn from other countries** e.g. bundle of coordinated policies

# Adoption of EE technologies

## Conclusions

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- **Combination of different** policy measures achieves **better results** than focusing on a specific instrument type solely
  - able to **consider a greater variety of impacts**
  - needs to be **coordinated** and **smart**
- Focus on **awareness raising** / include awareness raising programmes in policy mixes
  - **counteracts** barriers such as **uncertainties and concerns** about future benefits
  - highly **important if technologies are still under development**



# Thanks for your attention!

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