

# Companies' adoption of innovative energy facility

Tao Feng<sup>1\*</sup>, Gaofeng Gu<sup>1</sup>, Ad Breukel<sup>2</sup>, Hugo de Moor<sup>2</sup>, Brecht Zwaenepoel<sup>3</sup>

<sup>1</sup>Eindhoven University of Technology, The Netherlands <sup>2</sup>Avans University of Applied Science, Research Group Smart Energy, The Netherlands  
<sup>3</sup>WVI, Belgium. <sup>4</sup>Hiroshima University, Graduate School of Advanced Science and Engineering, Japan.



# Introduction

- CO2 emissions of SMEs in the tertiary sector (such as butchers, barbers, small food shops, restaurants and pubs) are significant.
- Initiatives to reduce CO2 by SME in tertiary sector exist but apply only for basic energy technologies (e.g., normal insulation). Efforts for innovative energy technologies are mostly applied by large organizations that invest in iconic sustainable buildings.

Examples Iconic Sustainable Buildings (Atlas TU Eindhoven and Pulse TU Delft)



# Introduction

## Innovative energy technologies

- Design/light weigh solar panels, heat pumps with special functions, ventilation with demand control, circular insulation, batteries, fuel cells + the integration of such technologies (e.g.: solar panels that generate the electricity for heat pumps with the support of a battery)

**However, investments in such innovative technologies by SMEs are scarce and depend on voluntariness and ownership of buildings.**

- The reason: entrepreneurs of the small(er) companies focus on their core tasks and not on the energy transition because they lack funding for high investment. This is especially the case when they rent the building.

# Background

The urgency to transfer from fossil fuel to renewable energy sources

- In residential sectors  
Fast progress and application in different countries  
Visible research related
- In industrial/office sectors:  
Less than 30% of small and medium-sized companies in Europe had implemented any measures for conserving energy and renewable resources.

SME companies in the tertiary sector are not yet equipped with innovative technology for renewable energy and energy efficiency.

# Research purpose

To investigate the acceptance of companies on innovative energy facility with a specific focus on the interrelationship between multiple alternatives.

We investigate the preferences of companies in different technologies:

- Solar panel
- Heat pump
- Ventilation

# TERTS

Meet the need for information about energy transition and guide companies in choosing innovative energy-efficient investments.

A wide categories of targeted groups:

*Hotel-restaurant-pub; Food & non-food stores, Bakeries, Butchers, Offices for entrepreneurs (banks, real estate)*

TERTS will make the sectors aware of the potential of energy transition and efficiency and also demonstrate, via demonstration sites, that energy transition is possible in the sector.

More information about TERTS can be found via <https://www.terts.org/>



# Data and methodology

Alternatives (solar panel, heat pump, ventilation) are featured with various attributes

Price (€) (<70m<sup>2</sup>)

Price (€) (from 70m<sup>2</sup> to 140 m<sup>2</sup>)

Price (€) (>140m<sup>2</sup>)

Subsidy from municipality

Annual reduction in energy charges

CO<sub>2</sub> reduction

Pay-back years

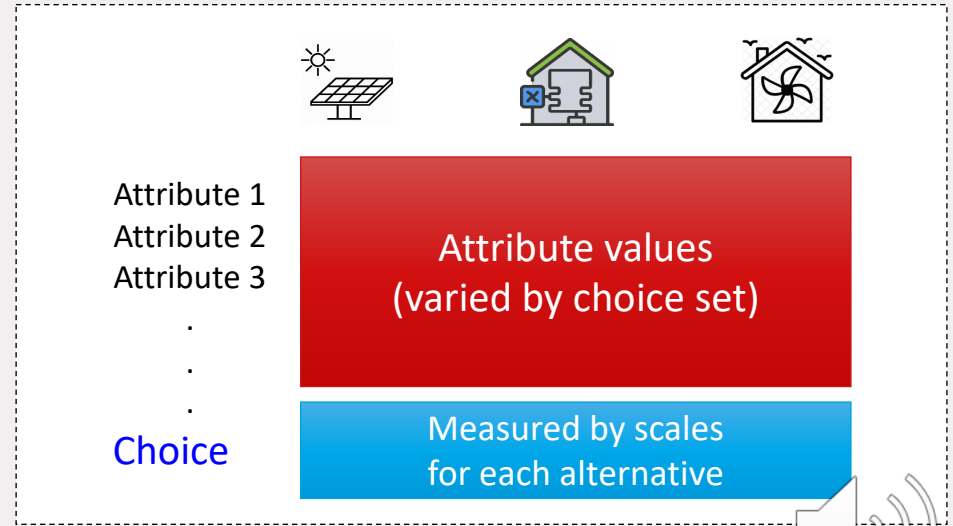
Function

Demand control

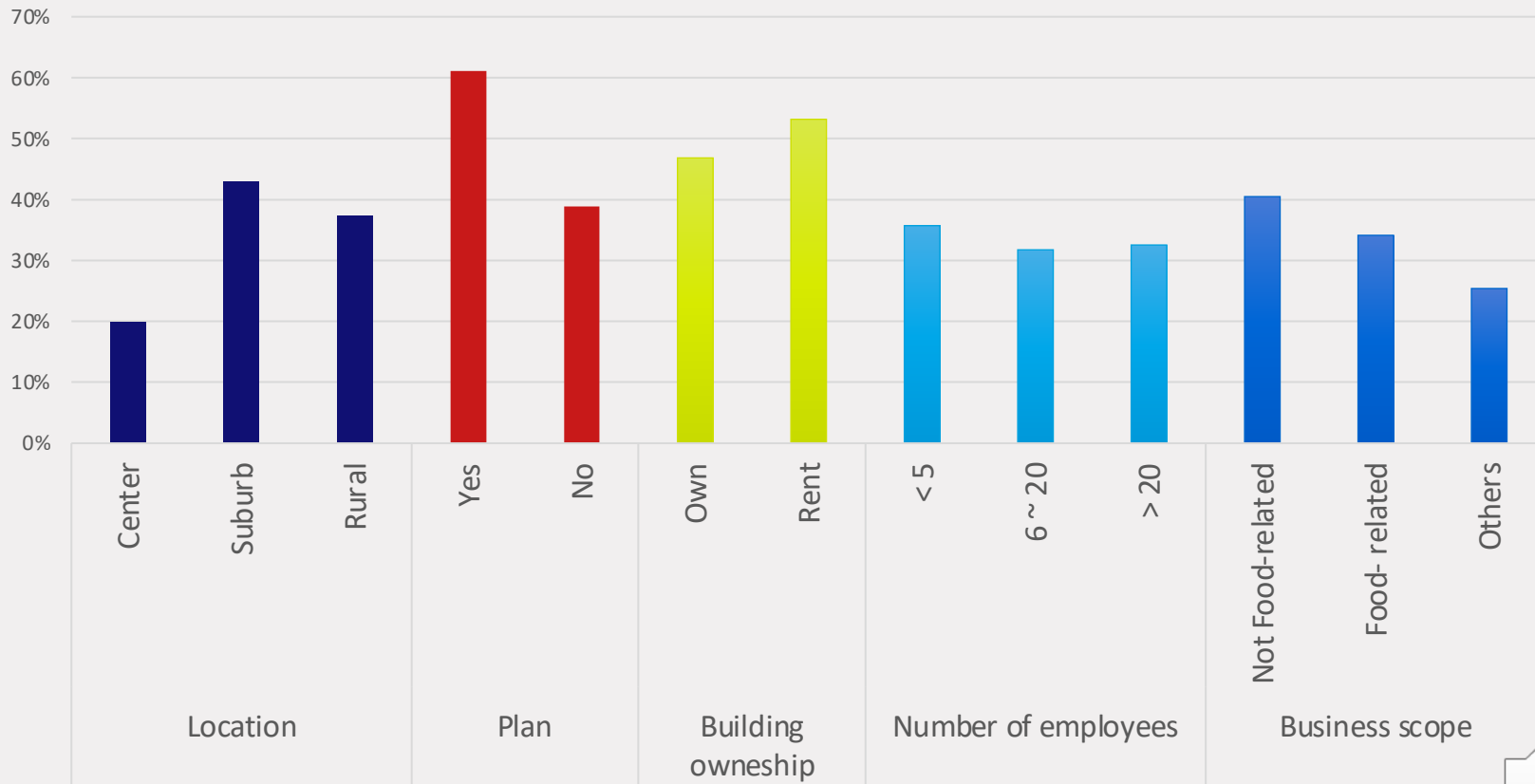
Can recover heat?

Can filter out pollutants?

- Companies in the Netherlands were randomly selected and invited to join the survey (e.g., a stated choice experiment).
- We collected the data of choice preference, company profiles, the goal of companies, etc.



# Company profiles





# Results Solar panels

- Installation price, payback period, subsidy, and energy charges reduction have significant impact on the acceptance of solar panels
- The acceptance of solar panels increases with the number of employees
- Food-related business such as restaurants and hotels have a higher intention to install solar panels than other companies
- The acceptance of solar panel in the city center is lower than the company in the suburb and rural.

# Results Heat pumps

- Installation price and payback period have significantly negative impacts on the acceptance of the heat pump.
- If the payback period can be reduced from 10 years to 5 years, the acceptance of heat pumps will increase dramatically
- The importance of emissions reduction for entrepreneurs is statistically insignificant, which is similar to the impact on the solar panel
- The cooling function has no significant impact on the acceptance of energy equipment

# Results Ventilation

- Subsidy has no significant effect.
- The function of filtering the pollutant and heat recovery have statistically significant impacts on the acceptance of ventilation.

# Findings Inter-energy facilities

- A bidirectional positive relationship exists between the acceptances of solar panels and heat pumps
- Companies who prefer one of the two, solar panels and heat pumps, are more likely to install the other one.
- A unidirectional relationship exists from solar panels to ventilation.
- Companies that choose ventilation are more likely to install solar panels

# Summary and conclusions

- Installation price, payback period and reduction in the energy cost impact the small and medium-sized companies' preferences.
- The decrease in CO<sub>2</sub> emissions is insignificant.
- The companies (city center or rural areas), number of employees and building ownership significantly influence the adoption behavior of innovative energy facilities.

## Future relevance:

- Support for SME's decision-making about energy technologies (e.g., how to use their own motives as a lever for investment, how to supporting them with paperwork and how can funding be supported).

# Thank you!

Tao Feng

Professor

Hiroshima University, Japan

*Mobility & Energy, Graduate School of Advanced Science and Engineering*

[taofeng@hiroshima-u.ac.jp](mailto:taofeng@hiroshima-u.ac.jp)

Eindhoven University of Technology, The Netherlands

*Urban Planning and Transportation, Department of the Built Environment*

[t.feng@tue.nl](mailto:t.feng@tue.nl)