

Adoption of Innovative Domestic Heating Systems in Sweden

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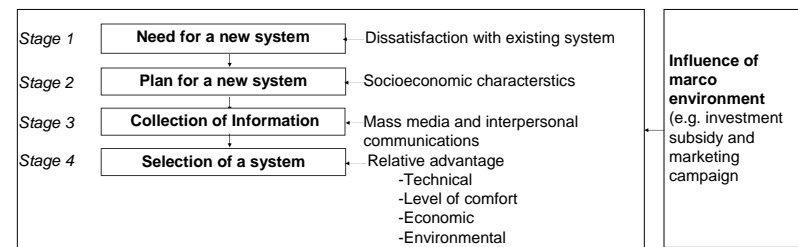
Research Motivation

- About 50% of the Swedish detached houses have oil and electric heating systems
- Potential for greenhouse gas mitigation by replacing these heating systems with innovative heating systems (IHSs) such as brine/water-based heat pumps, district heating or pellet boilers
- Homeowners' perceptions of the IHSs determine diffusion pattern of such systems

Objective

- To analyze factors affecting homeowners adoption of an IHS
- To understand the variation in rate of adoption of IHSs

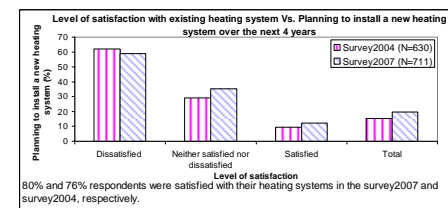
Theoretical Model



Methodology

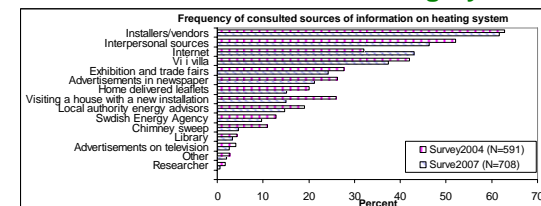
- Questionnaire surveys of 1,500 Swedish homeowners in Autumn 2004 (Survey2004) and Spring 2007 (Survey2007)
- Respondents selected through stratified random sampling by Statistics Sweden
- Response rate 44% and 48% in the Survey2004 and Survey2007, respectively
- No significant non-response bias was found from the comparisons of composition of respondents with respect to region, income, age and heating systems

Need for a New Heating System



- Significant relationship between respondents' plan to install a new heating system and their age, but not their income

Sources of Information on Heating Systems



Note: As many respondents indicated several choices, the sum of the percentages exceeds 100.

Technical Situation of Existing Houses

In the survey2004

- 69% of the respondents had hydronic system
- 61% had hydronic system and chimney
- 54% have hydronic system, chimney and space for pellet storage

Important Factors in Heating System Choice

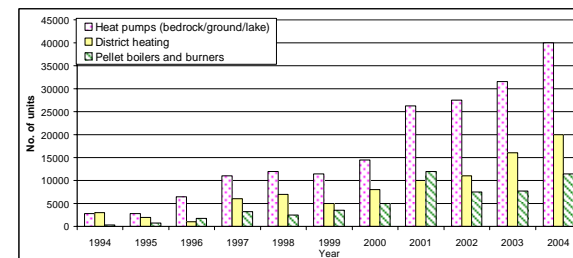
Survey2004		Survey2007	
Factor	Wilcoxon test	Factor	Wilcoxon test
Annual cost of heating	**	=	**
Functional reliability	**	=	**
Investment cost	N.S.	Indoor air quality	N.S.
Indoor air quality	**	Investment cost	**
Security in fuel supply	**	System automation	N.S.
System automation	N.S.	Security in fuel supply	N.S.
Environmental benignity	**	=	**
Increased market value of the house	N.S.	Low GHG emission	**
Low GHG emission	**	Increased market value of the house	**
Time for collection of information	=		

N.S. = not significant, ** significant at $p \leq 0.05$, = same as first column

Homeowners' Ranking & Relative Advantage of Heating Systems

Bedrock heat pump	Annual cost of heating Security of fuel supply Environmental benignity Market value of the house Low GHG emission
District heating	Functional reliability System automation Time required for collection of information
Pellet boiler	Investment cost

Annual Installation of Innovative Heating Systems in the Swedish Detached Houses



Conclusions

- More than 75% of the homeowners were satisfied with their heating systems and did not intend to install a new one
- Installers/vendors and interpersonal sources were the most important sources of information on heating systems
- Economic aspects, functional reliability and indoor air quality were the most important factors in heating system choice
- Pellet heating system had fewer relative advantages than a heat pump system and therefore, such systems diffuse slowly in Sweden
- Large proportion of homeowners were unaware about different aspects of heating systems

References

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4. Rogers, E.M., 2003. *Diffusion of Innovations*, Free Press, New York.