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Investments in Heat Pumps of German Households -  
A Quantitative Examination

**BACHELOR THESIS**

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# 1 Introduction

Although green technologies are increasingly being introduced in homes, only a few studies have examined the adoption or rejection of such household technologies. The climate crisis is a central issue in media and governments over the last past years, leading to a radical change in industry as well as on private household level. Old systems with high CO<sup>2</sup> emissions are being replaced by environmentally friendlier options and fossil fuels are no more infinite, which is slowly forcing the government to ring in the beginning of a post-fossil age.

The market for heating systems has been consisted of oil- and gas-based systems for ages, but within the course of this recent development, ecologically friendly systems like heat pumps, which operate completely without CO<sup>2</sup> emissions, are on the move as they promise to be sustainable and at the same time cost efficient. But can consumers really save money and act environmentally friendly just by switching their heating system?

An investment in a heating system is always costly, whether to renew an old oil-based unit or install an alternative, which implies that a decision on a case like this should be well-considered. Besides the costs, every person has their own priorities and attitude how to act and behave, so the factors which influence someone's intention to invest, differ from person to person. Nevertheless, when dealing with new alternative technologies, there are often key-factors which have a big impact on our attitude towards these specific systems.

This thesis firstly deals with the technology behind heat pumps on household level and the status quo including information about costs and benefits. Then the main component, the examination of key-factors concerning an adoption of heat pumps on household level, will be explained, evaluated and discussed. The target is to detect psychological and demographical characteristics that match the attitude and requirements of modern customers of heating systems.

The reason why concretely heat pumps are being researched is the fact, that theoretically – on the basis of technical factors like heating capacity, energy consumption or performance – heat pumps on household level are cost efficient very often, which has not been displayed in recent market shares.

For this purpose, a survey was created and evaluated, by which house owners have been asked about their attitude towards various topics relating this issue, to determine what exactly increases their desire to install a heat pump in their houses.

The applied method for evaluation is called “Partial Least Squares Structural Equation Modeling (PLS-SEM)”, which is a form of modeling that includes various statistical methods and algorithms to measure variables that cannot be measured directly (e.g. risk aversion), but indirectly by quantifying the approval towards specific items concerning them. This ability to measure latent variables is a big advantage over linear regression analysis.

The results of the survey are not only interesting for potential customers. They are also existentially for the heating industry, as companies always have to adapt customers' needs and wishes to their product strategies.

## 9 Conclusion

The main objective of this thesis was to examine the influences of people's intention to adopt heat pumps in their household. By developing a contextualized PLS-SEM model, the research provides strong evidence that, above all, environmental awareness is a key factor to influence the intention to invest in heat pumps (eventually leading to adopting those), as they are to be considered as a typical green technology: environmentally sustainable but not per se cost saving, because electricity costs are rising constantly and investment costs are often higher than those of other alternatives. Many interested people do not believe the technical specifications or are informed that the expectable COP is in fact set at a very high (unreachable) level. These exaggerated claims have yet resulted in mistrust towards this technology in many cases. But the technology evolves quickly, combating their main problem of electricity consumption, and the market share will continue to grow in the future by being applied in new buildings, where the advantages can be fully exploited; combining it with power-generating systems and planning the optimal type and position already while constructing the building.

Regarding the hypothesized role of trust in information, joy in household-investments and risk aversion, the results do not confirm the expected significance on intention to invest, nor any moderating effect on environmental awareness. Further examination could detect more indirect connections towards it via other factors, as in literature especially trust in information is seen as a favorable construct regarding its relation with other social-related factors.

A hypothesis which is measured to be not affecting intention to invest directly, but strongly linked with environmental awareness, is social pressure. In other words, the opinion and behavior of our social environment, like neighbors and media, actually increase the moral obligation to behave accordingly as well as a positive attitude towards green energies. By this relation, social pressure has a significant impact on our objective and will do its share to help establishing heat pumps in households.

But not only psychological factors are influencing people's attitude, there are also substantial differences in demographical groups, where the most important queried characteristics are a young age and a high education, while annual income and living space are not approved for certain but still highly anticipated.

Since renewable energy and environmental attitude are more important than ever, researchers have to understand how people think and where attention should be paid. This study provides an insight in the development of heat pump adoption and it would be useful to apply adjusted surveys (other/more constructs and more demographical characteristics) over a wider spectrum of demographical groups to identify their differences and needs.

Increasing the knowledge concerning influence on customer's behavior towards heat pumps is of course especially important for providers of such systems. Companies in heating branch with excellent knowledge of psychologically and demographically influencing factors have a big advantage towards their competitors, as they exactly know what product range to offer and how to develop a marketing strategy.