



PRACTICE BRIEFING

Incentives for individual metering and charging

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and charging

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Simon Siggelsten

Malmö University, Malmö, Sweden, and

Bengt Hansson

Construction Management, Lund University, Skane, Sweden

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Abstract

Purpose – The purpose of this paper is to look more closely at incentives for a landlord to use individual metering and charging of heat and water. This paper also aims to look at the possible reasons for the differences in use of individual metering and charging between Sweden and Germany.

Design/methodology/approach – The research in this paper is based on a questionnaire and interviews with landlords, in Sweden, using individual metering and charging.

Findings – The two main incentives for the landlords in the survey to use individual metering are the possibility to save energy and the possibility to create a fair allocation of heating cost between tenants. Sweden has a long history of heat and water included in the rent leading to a possibly tougher transition to individual metering.

Originality/value – To see the overall picture and understand the purpose of individual metering is important to avoid conflicts between landlords and tenants. The paper aids this process.

Keywords Energy consumption, Residential property, Sweden, Tenancy, Incentive schemes

Paper type Research paper

Introduction

Individual metering and charging systems are designed to allocate individual costs for heat and water in multi-family dwellings. The main purpose is to achieve fair cost distribution among the tenants based on their actual usage instead of flat sizes basis. In addition, individual metering and charging have shown opportunities to save money and lower environmental impact by reducing the energy use related to heating and water with approximately 10-20 percent (Berndtsson, 2003) and occasionally up to 40 percent (Kuppler, 1997). The European Union puts pressure on the building sector to improve energy performance through the Energy Performance of Buildings Directive (2002/91/EC).

Recently, a handful of countries in Europe have laws or specific rules for the use of individual metering and charging, for example, Germany, Denmark and Austria. For several reasons, this does not apply to Sweden where only 1.2 percent of all flats (year 2007) used some form of individual metering and charging (Boverket, 2008). Some Swedish studies show shortcomings with metering the heat individually in a fair manner (Andersson, 2001; Jensen, 1999), and others show that it is not always economically profitable (Boverket, 2008).

Regarding multi-family dwellings, the landlord decides on any installations of individual metering and charging systems. This study looks closer at a selection of landlords in Sweden who have chosen to install some kind of individual metering and



charging system to see what their incentives are. The study also looks into some historical events which can have affected the incentives in relation to heat and water costs. Furthermore, the study continues to discuss the overall picture and possible reasons for the differences in use of individual metering and charging between Sweden and Germany, where it is fixed by law since 1981 (Bundesministeriums der Justiz, 1981).

The basic idea of individual metering and charging

The basic idea of individual metering and charging (from now on, it will be referred to as individual metering only) in multi-family dwellings is to obtain fair distributions of the costs – tenants paying individually for their actual use of heat and water, i.e. lower indoor temperature and lower heat usage should result in lower costs for the tenant and vice versa. The option for individual preferences (within certain ranges) regarding the indoor temperature is also part of the idea with individual metering. Additionally, it can be a tool to increase the energy cost awareness among tenants and an opportunity to control the usage of heat and water. In general, energy cost awareness can result in some saving behaviours and reduced energy consumption. Not necessarily meaning that all tenants in a dwelling with individual metering will reduce their consumption of heat and water. But some previous studies show large possibilities for reduced energy usage, in an average of 10-20 percent reduction (Berndtsson, 2003) and occasionally up to 40 percent (Kuppler, 1997). Because of installation and operation costs, energy savings do not necessarily link to economical savings (Boverket, 2008).

Recently, three different types of individual metering of heat in multi-family dwellings are normally used (Boverket, 2008, p. 32):

- (1) *flow metering* – measurement of flow and temperature of water circulated in a radiator system;
- (2) *radiator metering* – measurement of emitted heat from radiators through installed sensors; and
- (3) *temperature metering* – measurement of actual temperatures through sensors in certain locations of the flat.

Individual heating is a fourth option, where each flat is equipped with its own boiler and therefore charged individually. Individual heating can be appropriate in smaller dwellings with no common spaces suitable for installation of a common heating system. Multi-family dwellings with condominiums can also benefit if the common spaces and equipments can be reduced.

Shortcomings with individual metering

Some complex shortcomings with individual metering of heat are caused by the interactions between flats in multi-family dwellings; the heat transport through common walls. The temperatures of the neighbours' surrounding flats can result in large varieties of energy use (Andersson, 2001; Jensen, 1999). Also the location in the building can lead to different heating needs, e.g. a flat located in the middle of a dwelling has much less surface of outer walls than a flat on the top floor or at a gable. Other conditions, such as floors, point of the compass, wind exposure and differences in the building envelope, also make differences of heating needs for each flat (Kenworthy, 1978). The building envelope is the landlord's responsibility, but any local defects will burden the individual tenant with a greater need of heat.

Individual metering of water does not have similar problems and shortcomings as of heat. It is possible to accurately measure the individual water usage with a flow meter in the incoming water pipe of each flat. The tenant pays for the actually used water, e.g. coming out of the tap and used by washing machine and dishwasher. In contrast with heat metering, water is not affected by surrounding neighbours' flats.

Additional shortcomings can occur depending on the technique used for individual metering of heat (Berndtsson, 1999; Boverket, 2008). Also, different dwelling structures and conditions can affect the individual metering, e.g. the already-mentioned building envelope, but also the quality of the insulation between the flats and the function and technology of the heating system.

Individual metering of heat can be apprehended as a complex system demanding a certain level of previous knowledge. Complexity and possible shortcomings could raise questions of why using it at all but the approach would be affected by different backgrounds and ways of looking at things. Previous knowledge may have a controlling influence on how new information is adopted (Lindström, 1990). A step towards gaining previous knowledge and creating an overall picture of individual metering is to understand what has already happened, the history.

Some historical events in relation to heat

From mid-nineteenth to early-twentieth century, all flats were heated up individually by its own fireplace and the tile stove had its glory days. But in the 1920s, central heat started to make its entry in Europe and the tiled-stove started to lose its primary function (Larsson, 1979). There were several advantages with central heating sources. For example, the tenants, respectively, did not have to acquire fuel themselves and hot water could be heated centrally and easily distributed throughout the building. With central heat, the cost of heating and hot water was transferred from tenant to landlord which became a problem.

The rental solutions in Sweden became the excluding and the including systems (Fritjof, 1951; Zetterberg, 1969). The excluding system did function with a fuel surcharge to compensate for the increased heating costs for the landlord. The fuel surcharge was based on actual cost for heating up the whole dwelling per annum. The cost was divided equally among the flats, based on flat sizes. The including system with cost of heat and water included in the rent was based on estimated average consumption, over a long period, for the specific dwelling. Over time, the predominant system in Sweden has been the including system.

In Germany, in contrast to Sweden, the central heating became the starting point for individual metering and basic thoughts on how the costs for heating could be distributed (Boverket, 2006). Kuppler (1997) shows figures from attempts with individual metering as early as year 1929. Recently, Germany has two predominant techniques to measure heat usage; a gauge mounted on the incoming heat pipe or gauges mounted on all radiators measuring the actual use of heat in each individual flat. Any disadvantages of heat transport between neighbours' flats and defects on building envelopes existed before introducing central heat and the introduction of individual metering. The conditions are the same today when measuring the actual heat usage for all flats individually as before when all flats were supplying their own heat. The acceptance for individual metering in Germany is large (Boverket, 2006) and since 1981 individual metering of water and heat is fixed by law (Bundesministeriums der Justiz, 1981).

Current research and further opportunities

One advantage with individual metering is the opportunity to reduce the use of energy. But there are several other possibilities, besides individual metering, to achieve reduced energy use in dwellings. Harvey (2009) presents how dwellings dramatically can reduce the energy use with 50-75 percent through energy-efficient systems and by improving the building envelope. Badescu and Sicre (2003) show the possibility to build dwellings and buildings with specific passive house construction designs leading to a tenth of the heat energy consumption compared to similar standard design buildings. The interest in low-energy buildings and energy-efficient systems is increasing worldwide together with the increased awareness of climate impact and ecological footprints, but there is still a long way to go before all landlords will do energy efficiency investments. Högberg *et al.* (2009) show in a study made in Sweden, that there are large and unpredictable variations of landlords' approaches to energy-efficiency investments.

Methodology

A survey was conducted to get a better understanding of the incentives for landlords to introduce and use individual metering. The survey, made in Sweden, was based on an internet questionnaire and interviews approaching landlords who all use some form of individual metering. The questionnaire was sent to 26 municipal landlords resulting in 23 respondents (88 percent). The interviews were made with three municipal and two private landlords. The idea was to do additional interviews, but a certain saturation of the different incentives occurred. With a saturation of incentives, additional interviews do not contribute with any more knowledge (Kvale and Brinkmann, 2009). But with less participating landlords, the percentage dispersion between the incentives becomes more uncertain. The reason for the combination of internet-based questionnaires and interviews was strategic, to get a wider spread of respondents across the country.

The main reason with the questionnaire was to understand the incentives behind why some landlords choose to install individual metering. To not influence their answers with predefined alternatives, an open question was used about the incentive(s). All respondents were also asked such general questions as: "How many years have you used individual metering?"; "In how many flats have you installed individual metering?"; and "Are you informing the tenants how they can save heat and water?"

The study also included a literature survey. The search for individual heat metering resulted in relatively few hits and most of the hits were from Germany and Sweden. In Germany, there are no discussions of the to be or not to be of individual metering, but there are ongoing discussions about various products and technologies related to individual metering. Sweden have several reports because of the ongoing debate about the pros and cons with individual metering.

The majority of landlords using individual metering in Sweden are municipal, while private landlords and condominium associations are greatly underrepresented (Boverket, 2008, p. 10). The municipal landlords in Sweden direct towards the whole population and it is not any kind of social housing in the traditional sense. The survey covered approximately 40 percent of all flats in Sweden with any form of individual metering. In 2007, individual metering systems were installed in approximately 29,000 of a total of 2.4 million flats in Sweden (Boverket, 2008, p. 7). None of the landlords in the survey have individual metering installed in all of their flats but only in flats of some selected properties. The smallest landlord in the survey possesses in total

890 flats and the largest landlord possesses in total 30,000 flats. The summary of the participating landlords is shown in Tables I and II.

Findings

One of the private landlords who participated in the survey was just in the beginning of the process of installing individual metering. Four of the landlords were only using individual metering of water and not of heat. Two of these four had previously used individual metering of heat but discontinued and they are now using individual metering only for the water. Additionally, one landlord has plans on discontinuing the individual metering of heat. They have all given the same reason; that it has not been economically profitable. One of them also declared a more detailed reason: “to fulfil the tenants’ option for higher temperature, an increase of the possible outlet temperature for the heating system was necessary. The increase of the temperature costs more than the savings made with individual metering.”

About 93 percent (26 out of 28) of the landlords answered the question concerning their incentives for using individual metering and charging of water and heat. Some of the respondents answered with more than one incentive. The results are shown in Table III.

None of the landlords have individual metering installed in all of their flats but only in some selected parts of their possessions. And only five landlords have individual heat metering in all of the flats where they also meter the water. This means that 18 landlords do not meter the heat in all flats where they also meter the water, in other words, heat metering is less frequent than water metering in this survey.

Amount (number of flats in possession)	Participants (number of landlords)
<7,500	14
7,500 < 15,000	3
> 15,000	6
Sum	23

Table I.
Landlords who participated in the questionnaire

Amount (number of flats in possession)	Participants (number of landlords)
<7,500	1
7,500 < 15,000	3
> 15,000	1
Sum	5

Table II.
Landlords who participated in the interviews

Landlords	Incentives to use individual metering
14	To save energy and hence the environment
8	To create an equitable allocation of heat and water costs
5	To make an economical profit
5	Just to try out the technique, for curiosity
2	Other or do not know

Table III.
Landlords’ incentives to use individual metering

Three of the five landlords who participated in the interviews, informed about problems with tenants who complain about the individual metering of the heat. The tenants argue that the metering of the heat is not fair. Additionally, one landlord acknowledged occasional complaints of unfair heat metering, but no major issues. The fifth landlord who participated in the interviews was just in the beginning of the process of installing individual metering.

One of the landlords who participated in the interviews chose not to charge for heat and water when using individual metering the first year. This first year was used as a probationary period in order to inform each tenant about their individual consumption profile.

Discussion

By using individual metering, multi-family dwellings have opportunities to reduce the energy use (Berndtsson, 2003; Kuppler, 1997). In Germany, where the starting point for individual metering was in connection with the introduction of central heating, individual metering of water and heat is fixed by law (Boverket, 2006). Historical progress and legislation provides probably the basis for the general acceptance and perception of individual metering among German landlords and tenants. This study does not investigate whether Germany introduced the legislation on the basis of possible energy savings or to achieve fair heat cost allocations. However, the general acceptance and perception of individual metering among landlords and tenants in Sweden and Germany, respectively, will probably differ a lot. Any new technique or procedure should be justified, which can be done in various ways, either because there is something to gain or because there are limited choices. When central heating made entry into cities, conditions for the allocation of heating costs was forced to change. In Germany, landlords chose to meter the heat individually for each flat. This created additional work compared to fixed rates based on flat sizes but landlords in Germany probably wanted to keep similar cost distributions as before central heating made entry into the cities. In Sweden, with the predominant including system – heat and water included in the rent; there is a larger step to introduce and accept individual metering. Especially now with several investigations pointing out possible shortages with the current metering techniques (Berndtsson, 1999; Boverket, 2008). Landlords not only require clear incentives but they also need to convince the tenants. This study demonstrates reasoning for individual metering among Swedish landlords. The survey showed a saturation of the possible incentives that could exist for landlords to begin with individual metering, and thus a possibility for a good overall picture of valid incentives and understanding how landlords in Sweden argue and act. Considering the very limited spread of individual metering among Swedish landlords, the question is whether opportunities exist and if the incentives are perceived moderate only. Maybe, the incentives and opportunities have not even reached out to the landlords.

To save energy and hence the environment

The most popular incentive given by the landlords (14 out of 28) in the survey was the possibility to reduce energy consumption and hence saving the environment. It can be difficult for a landlord to justify an installation of individual metering entirely because of the possibility to make an economic profit. Is an environmental benefit just extra help on the way to motivate tenants to accept individual metering? And can arguments for lowered environmental impact overcome the shortages with

the current metering techniques? These questions can probably only be answered by each individual landlord and tenant. In general, any possible reduction of energy consumption is calculated as a percentage and it has an effect on this incentive for individual metering. Percentage reduction of energy use makes individual metering more profitable for dwellings with initially larger amount of used energy; and less profitable otherwise. Thanks to the increased global awareness of our environmental impact, the desire has increased to build more energy efficient dwellings and to improve the building envelopes of existing dwellings. There are great potentials for improving the energy efficiency of existing buildings and dwellings (Harvey, 2009) and it is also possible to build highly energy efficient buildings and dwellings (Badescu and Sicre, 2003). All in all, this reduces the potential savings with individual metering of heat. The potential savings with individual metering of water is larger, even in low-energy dwellings, because the water usage is affected by the individual tenant and not by such as insulation standard of the dwelling. Reduced saving potentials can lead to reduced interest in individual metering unless there are other strong incentives too.

Individual metering of water but not heat

Four of the landlords in the survey used only individual metering of water. Two of them had previously used individual metering of heat too but had discontinued and further one had plans on discontinuing. Overall, metering of heat is less frequent than of water and only five of the participating landlords had individual metering of heat in all of the flats with metering of water. Maybe, as an effect of shortages related to the heat-metering techniques. Possible complaints from tenants could encounter resistance against increasing the amount of flats with individual metering, particularly of heat. But the cause could also be economical.

To make an economical profit

To fulfil the tenants' option to choose indoor temperature within certain ranges, some landlords might need to increase the possible heating temperature. In combination with other energy saving measures, the effect and economical profit of individual metering of heat could be lowered and for some landlords not economically profitable at all. However, individual metering of water is more profitable, as the survey also indicates.

Incentive – to create a fair allocation of heating costs between tenants

To create fair allocations of the costs for heat and water between tenants is an incentive as eight out of 28 of the participating landlords in the survey wants to achieve. Landlords having fair allocation of heating costs as primary reason for individual metering might have assumed it on uncertain basis considering the shortages with the current available metering techniques.

The shortages related to individual metering of heat could create conflicts between landlords and tenants. Three of the five interviewed landlords indicated occasional problems with tenants who complained about unfair allocations of heating costs. Individual metering of water is not as complicated as of heat and is generally considered to give fair cost allocations. But the perception of fair or unfair allocations of heating costs is not necessarily the same in different countries. In Germany, the development of different metering techniques for heat cost allocation started as early as in the 1920s (Boverket, 2008; Kuppler, 1997). The transition from tiled stoves to central heating had

just started, and heat and hot water was not included in the rent since all tenants have had their own heat sources. It resulted in an easier acceptance among German tenants regarding installations of individual metering systems and generally perceived as fair methods. Water metering is in general easier to accept and justify for all parts because of today's accurate metering techniques.

To facilitate the transition to individual metering avoiding drastic changes, it could be done in smaller steps. First step could be to initially meter the heat just for the sake of information as one of the participating landlords in the survey did. This would give the tenants an insight in their individual consumption of heat and the impact on the rent. The same approach would also be applicable for water metering. The tenants are given some time to adjust the consumption – lowering the risk for a sudden unpleasant rent increase. The landlord could simultaneously provide detailed information to the tenants on how to save energy through lowered heat and water use, which also two-thirds of the landlords in the survey did. Another idea would also be to inform the tenants about the environmental profits they could make.

Individual metering – just for curiosity

Five out of 28 of the landlords indicated that curiosity about technology played a role in the decision to install individual metering. Högberg *et al.* (2009) show in a study made in Sweden, that there is a large and unpredictable variety of landlords' approach to energy efficiency investments. A general curiosity about technology might be a contributing factor to the variable distribution of landlords who have chosen to make energy-saving investments or renovations.

Conclusion

The two main incentives for the landlords in the survey to use individual metering are the possibility to save energy and hence the environment (50 percent) and the possibility to create a fair allocation of heating cost between tenants (29 percent). Sweden has a long history of heat and water included in the rent leading to a possibly tougher transition to individual metering. To see the overall picture and understand the purpose of individual metering is a key to avoid conflicts between landlords and tenants.

As the energy saving of heat is calculated as percentage, the largest opportunities for profitability with individual metering are among dwellings with a currently higher energy use. And the necessity for individual metering is for this reason questioned. Recently, with an increasing number of energy-efficient dwellings and techniques to achieve energy-efficiency, there might not even be a need for individual metering of heat fixed by law, unless the intension with the law would be to create fair allocations of heat costs. It could be a good idea to have a law regarding individual metering of water since the water usage is influenced by the individual tenant only. This study could contribute with knowledge and awareness to those countries discussing regulations for individual metering, such as fixing by law.

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Corresponding author

Simon Siggelsten can be contacted at: simon.siggelsten@mah.se