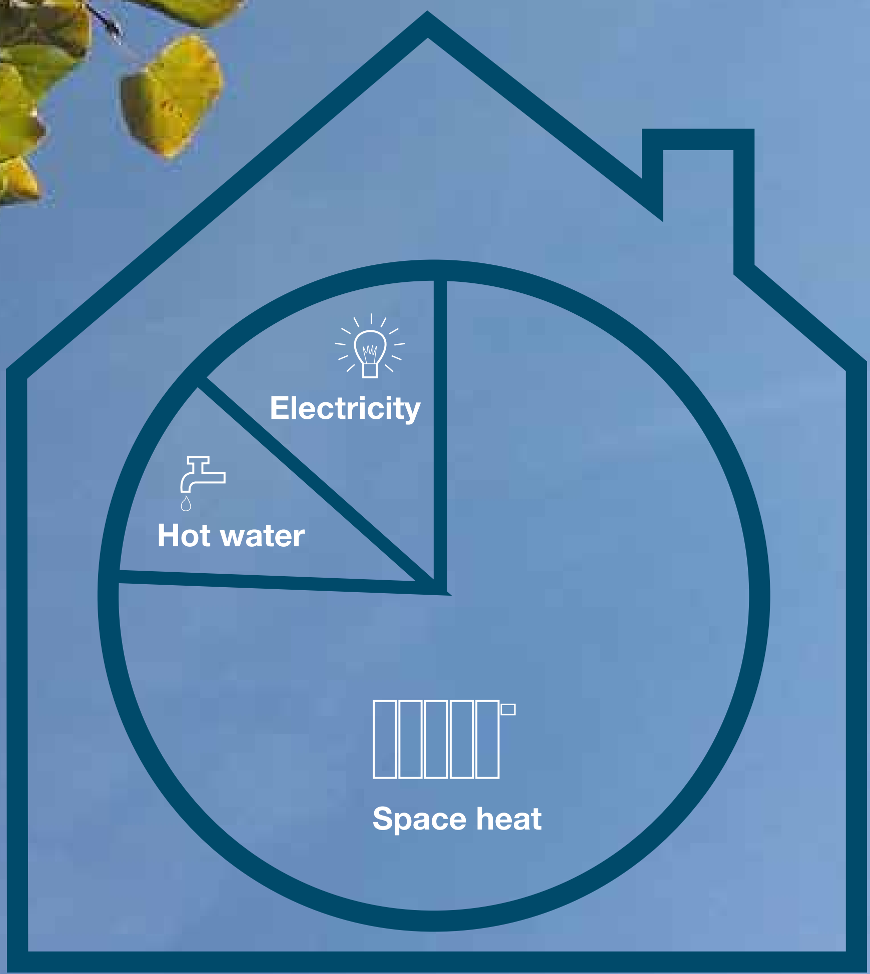
HOUSEHOLD ENERGY USE

EFL WORKING GROUP ENERGY EFFICIENT BUILDINGS & EU SUBSIDIES



EUROPEAN FEDERATION FOR LIVING

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1. Foreword

This report presents results from research and know how of the Topic group Energy Efficiency on the topic household energy use. It is mainly written with the input from the members of the Topic Groups Energy Efficiency and EU Subsidies and is based on the dedicated meeting “Insight in domestic energy use”, which was held on September 9, 2015 in Essen at the headquarter of ISTA. A kind word of thanks to the ISTA organisation who hosted a very interesting and well prepared and attended meeting. The participants of the meeting are listed on the last page of this brochure.

2. Introduction

Domestic energy use presents a large part of the total energy consumption in Europe. Therefore the housing sector is challenged to respond to global warming and high CO2-emissions through measures to reduce consumption of primary energy sources (oil, gas, coal). Roughly, energy consumption in the housing sector can be viewed from two perspectives:

- the object side: **the building**
- the subject side: **the resident**

In this brochure, the EFL Topic Group Energy Efficiency focuses on policies and instruments related to energy reduction by end users. We start with a general introduction to the topic by showing some results from scientific research related to household energy use in Europe. A separate paragraph is dedicated to the Rebound effect: the fact that the actual energy use of renovated buildings is very different from the predicted or calculated energy use. Here we find that both physical aspects of the building and building services equipment, as well as user behaviour, accounts for this mismatch.
We continue with more practical approaches and solutions to contribute to energy savings caused by residents, including: Sub-metering (ISTA), Energy monitoring systems (ISTA), Collecting and operating building data (Intent Technologies), Business models for energy management for housing companies (Ritterwald) and the TRIME project (Trias Mores Energetica): an European funded EFL project, focussed on promotion of energy efficient behaviour of tenants in the social housing sector.

3. Household energy use from a scientific point of view

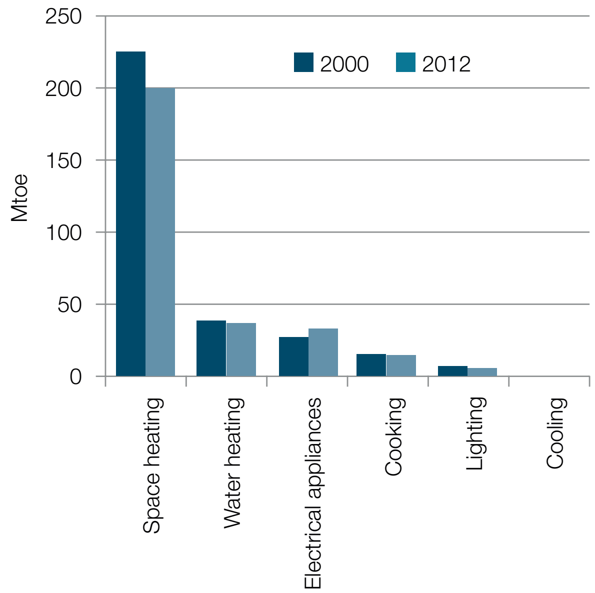
Results taken from the research project **'Energy Efficiency Trends and Policies in the Household and Tertiary Sectors'** are presented below as a general introduction to household energy use in Europe. It is an analysis based on the ODYSSEE and MURE Databases (June 2015), a project funded by the EU within the framework 'Intelligent Energy Europe'. We present the main conclusions from the project:

- In summary, household energy efficiency has improved by 1.8% per year at EU level since 2000, thanks to the energy efficiency improvement for space heating and the diffusion of more efficient new electrical appliances (e.g. labels A+ to A++).
- The household energy consumption per dwelling has been decreasing regularly in most countries since 2000 (1.5% per year at EU level). Since 2008, electricity consumption per household has also decreased in many countries.
- The efficiency of household space heating, measured in kWh or GJ/m^2, has improved steadily since 2000, by around 2.3% per year at EU level. The reasons are the deployment of more efficient new buildings and heating appliances and the renovation of existing dwellings. The low volume of construction since 2009 has, however, limited the impact of new dwellings standards. As a result of these trends, the share of space heating in total household consumption is declining (4 percentage points less than in 2000).
- The consumption of small electrical appliances has been growing rapidly until 2007 so that they now represent a higher share of the total consumption of appliances than large appliances. Large appliances are more and more efficient, with efficiency gains around 35% for cold appliances (refrigerators and freezers), washing machines and dish washers since 1990, thanks to labeling and eco-design regulations.
- The specific consumption per dwelling for lighting has decreased since 2000 in half of EU countries and at the EU level thanks to the diffusion of CFLs and LEDs.

(source: http://www.odyssee-mure.eu)

Increased use of ICT can increase the energy consumption of an individual office or service but in the society as a whole **digitalization is reducing energy consumption** by, e.g. reducing mobility needs and more efficient use of space.

Breakdown of household engergy consumption by ens-use in the EU



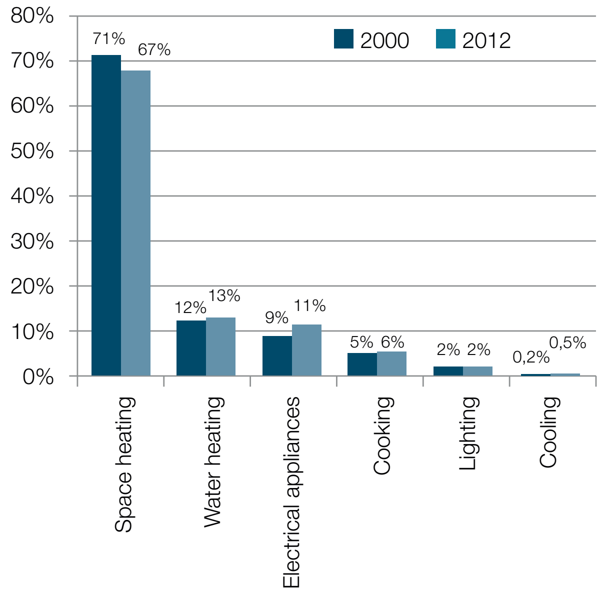


Figure 1 Breakdown of household energy consumption by end-use in the EU. Source: ODYSSEE

EU covenants are targeted to save 20 percent of the primary energy used in the built environment by 2020, compared to the reference year of 1990. Mainly by renovation of existing buildings to energy label B. The overall aim is even to have an energy neutral building stock by 2050. To be able to reduce the household energy use, adequate data are needed to gain insight. *Laure Itard* of the OTB research group of Delft University of Technology presented results from research related to actual energy use in dwellings. Although before 2010 it was difficult to get data about domestic energy use, after 2010 a lot of data became available, due to EU legislation as the EPBD (Energy Performance of Buildings Directive) and national registration of energy labels. Since then, good opportunities to monitor energy use on a large scale have become available. It marks the start of introducing monitoring systems, but at the same time raising the challenge to get the needed *relevant* information out of all the data.

In scientific research performed by the OTB research group of Delft University of Technology, actual energy use is linked to the characteristics of buildings for a better understanding of the performance of the Dutch housing stock. There is access to data of more than 80 percent of the Dutch Social Housing stock, which in turn accounts for 30 percent of the total housing stock in the Netherlands.

The Rebound Effect after retrofitting

According to the **theoretical** prediction of gas consumption per m^2 per dwelling per energy label, a renovation from energy label F to B results in an energy reduction of **66 percent**. However, measurements in 200.000 dwellings show that the **actual** energy reduction would be only **36 percent** (See Figure 2). This effect is described by TU Delft as the Rebound effect.

Actual and theoretical gas consumption per m² of dwelling per energy label

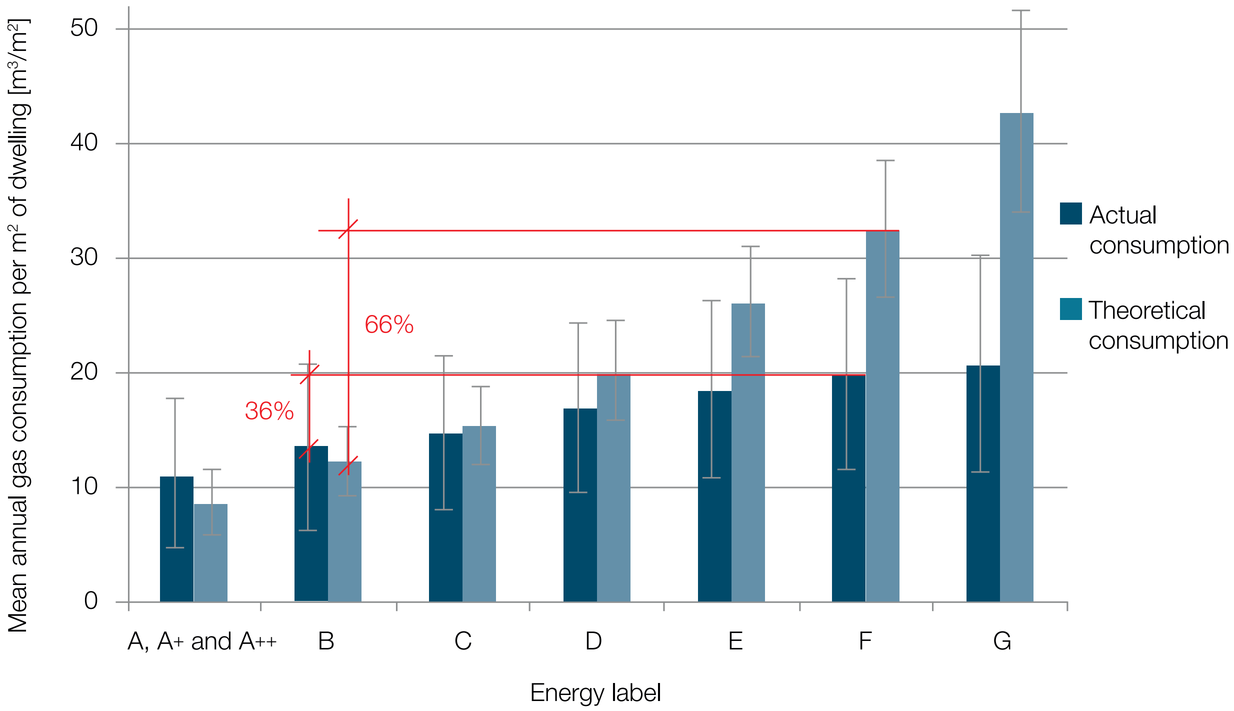


Figure 2 Actual and theoretical gas consumption per m² of dwelling per energy label. Source: Majcen, D, e.a. Energy Policy 2013

There are different **reasons** for the **differences between predicted and actual consumption per energy labe**l. One of the reasons is **poor estimation of physical characteristics of older homes** which have not been taken into account in the calculations. Another reason can be that the calculation method is at `equal comfort', while people live in different indoor climate depending on the label of their homes. According to scientific research of Ghent University, the temperature range in old dwellings is larger than in new homes. Different occupant behaviour in different labels can also influence the energy use. For example, it has been found that **people with a manual thermostat turn it off more often** than people with a programmable thermostat.

However, the research also concluded that it is not easy to determine the exact causes of the differences found between actual and predicted (or calculated) energy uses, since there are many parameters influencing this.

Another example to clarify the rebound effect (figure 3): during a renovation (energetic retrofitting) a gas stove is replaced by floor heating, causing the average day temperature to rise from 14°C to a constant 21°C. It might then be questioned whether disappointing energy savings after the renovation are caused by occupant behaviour or physical characteristics of the renovated dwelling. With the new heating system it is only possible to heat the whole room instead of a part of it by one radiator. The higher than expected energy use is thus probably **caused by the system and not by the user**.

During a renovation a gas stove is replaced by floor heating

Equel comfort?
Occupant behaviour (rebound) of physical characteristic?

Average day temperature ~14ºC

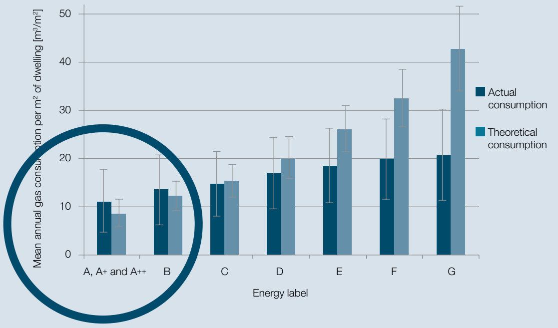
Average day temperature ~21ºC

Figure 3 Effect of replacing a gas stove by floor heating (Laure Itard TU Delft – OTB Research group)

Insight into gas consumption related factors is needed for better prediction of the gas consumption. Some interesting gas consumption related factors were presented by Laure Itard on the meeting in Essen:

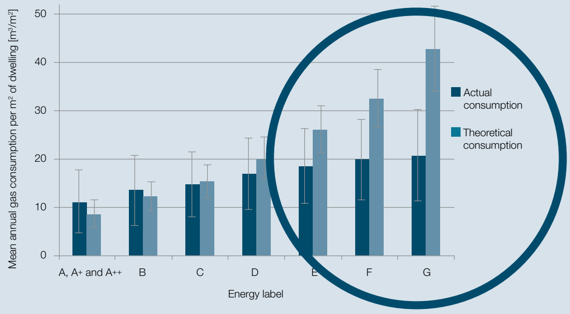
The difference between the actual gas consumption and the predicted gas consumption increases in case of high energy labels when:

- People are more often present
- There is a programmable thermostat
- There is NO water saving shower head



The difference between the actual gas consumption and the predicted gas consumption increases in case of low energy labels when:

- Buildings are old
- Smaller reported heated floor area
- Old heating system
- Lower average reported temperature when nobody is at home
- People report they often feel too cold



Essen:

After a building refurbishment the **savings** are often lower than expected; **generally only half of the expected savings are achieved**. In a case study thesis of Jad Khoury, Université de Geneve “Zoom on dwellings renovated between 2010 and 2012” (SHAERE DATABASE), the situation before and after renovation has been compared to find out what the actual effect is of changing the heating system, ventilation system, glazing or insulating the envelope. The outcome was that for most of the measures the savings are over estimated. The **predictions of energy use** after improvements or renovation can become more accurate by **correcting calculations with statistical data**, such as correction per dwelling type and heating.

4. Sub-metering

Sub-metering provides transparency of individual energy consumption to tenants and apartment owners. Ulrich Fischer of Ista informed the Topic Group about the effects of sub-metering. **Space heat and hot water accounts for 87% of the total energy consumption of a residential building** (Figure 5) and user behaviour has a large influence on it. Therefore sub-metering has tremendous savings potential in centrally/district-heated buildings. For tenants it becomes worthwhile to change their behaviour in terms of energy use when it does influence the energy bill. Sub-metering gives insight in the individual energy use and tenants pay for their own consumption instead of per m^2 (Figure 4). **Sub-metering empowers the consumer to steer their own energy consumption and directly contribute to energy savings**.

It has been mentioned that it is important to take the energy losses between boilers and apartments (20-30%) into account, so the total required energy is not just a sum of the energy used by tenants but includes also de losses.

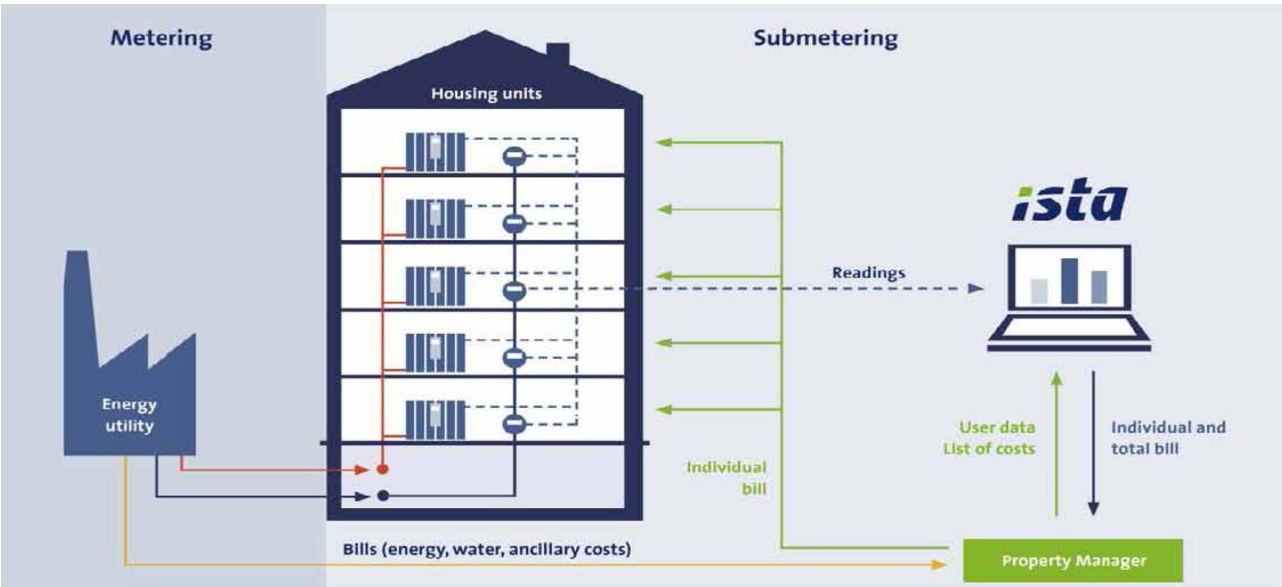


Figure 4 Metering vs. Sub--metering (ISTA)

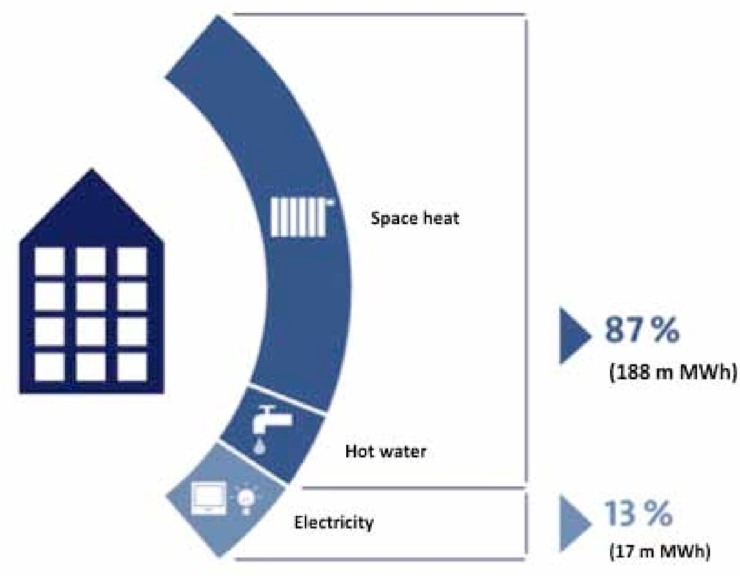
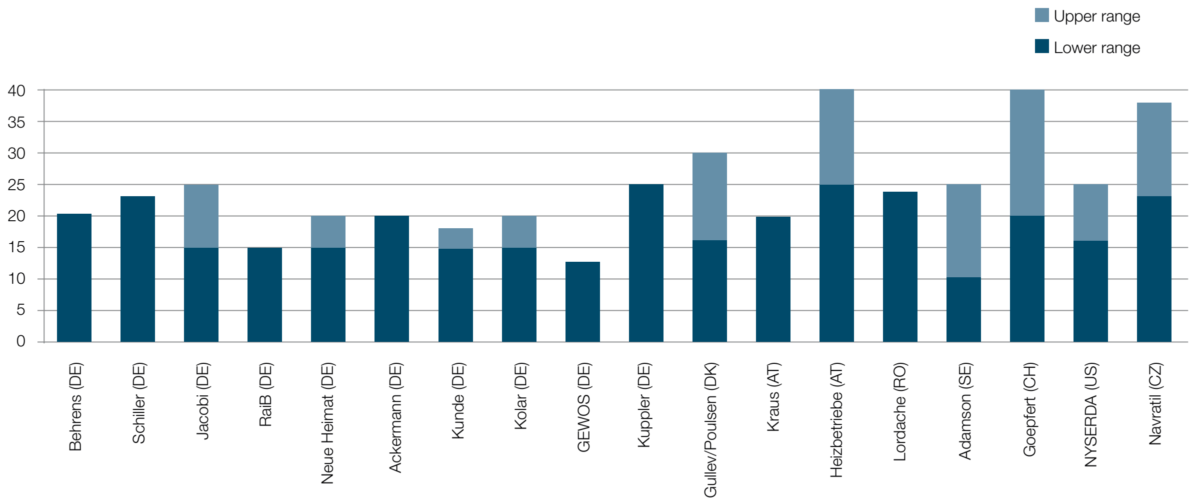


Figure 5 Heating and hot water account 87% of the total energy consumption of a residential building (ISTA)

Several studies confirm energy savings of 20 % or more through sub-metering implementation (Graph 1). Since the savings are reached by change of user behaviour, showing again that user behaviour is very important. Therefore responsible use of ventilation and heating system must be explained to residents.

Graph 1 Studies show energy savings through heat sub-metering implementation is mostly 20% or more (ISTA)

Studies on energy savings through heat sub-metering implementation (in%)



There are multiple examples of projects were the effect of sub-metering is tested in practice. An example of a best practise project of Ista is the *RSN Ursus project in Poland*. The project started in 2010 with in total 146 buildings of 4 housing cooperatives. The conclusion was that 90% of all participants in the project achieved significant energy savings (~20%). Also a **comparison** has been made between **two buildings** with the same size and age where at one building **sub-metering** was implemented and the other was **insulated**. The result from scientific research showed that the insulated building, where heat consumption is billed per m2 more energy was needed than for the non-insulated building where sub-metering was implemented. In the latter the tenants had access to information about their own use and energy use was calculated based on their own consumption. After the first year of use a reduction in heat consumption was reached by over 1000 GJ for the 8 tested buildings together.

Keep users motivated

Central question to individual sub-metering and influencing the user behaviour is: will their behaviour change permanently? Will people stay motivated to look after energy saving behaviour by for example taking a short shower or reduce room temperature? These questions are urgent when sub-metering is compared to insulation since insulation is a long-term investment. If tenants stay motivated sub-metering is also a long-term investment but this critical note should be kept in mind.

Sub-metering economically meaningful

Whether sub-metering (of space heating only) becomes economically meaningful considering the 20% consumption reduction on space heating depends on energy prices which differ per country. Research of Felsmann/Schmidt („the Europäisierung der deutschen Studie zu Auswirkungen der verbrauchsabhängingen Abrechnung“, ISTA July 2014) learned that:

Sub-metering becomes economically meaningful for heat consumption higher than:
30 kWh/m2a in Poland
40 kWh/m2a in France
27 kWh/m2a in Italy
38 kWh/m2a in Sweden

The higher the energy prices, the sooner it will pay off.
Sub-metering has low capital expenditures requirements compared to other efficiency measures such as insulation, while the energy savings per apartment are almost the same. **Therefore it is interesting to consider sub-metering before a large investment in insulation is performed**.

Energy Efficiency Directive (EED)

The Energy Efficiency Directive supports the EU to reach its 20% energy efficiency target in 2020 by a set of binding measures. One of the measures is sub-metering.
The number of dwellings where sub-metering is applied varies per country. Germany was among the pioneers and has been implementing sub-metering since the early 80s, therefore sub-metering is well-known in Germany. Austria and Denmark followed soon after and later Romania and Poland followed. Today the EU commission has recognised the benefits of sub-metering and included it in the measures foreseen in the EED. EED Article 9-13 are focused on implementing sub-metering in all countries, see below a summary of the content of the articles drafted by Ista.

The restructuring of the global energy systems requires new energy efficiency solutions

Art. 7 introduces a mandatory energy efficiency scheme to ensure that certain energy distributors or retail energy sales companies achieve an energy savings target of 1.5%. Equivalent strategic measures can be counted, e.g. billing information.

Art. 9 introduces the installation of individual meters / heat cost allocator for central, district heating and hot water.

Art. 10 sets up accurate billing / billing information which is based on actual consumption.

Art. 11 sets up consumer protection rules for costs of access to metering and billing information. Costs of installation and billing is passed to the resident as beneficiary.

Art. 13 penalties shall ensure that billing is implemented according to actual consumption.

5. Energy management- System support for end users

Dario Cohen of ISTA presented energy management systems in social housing based on **French** examples. Energy management by tenants in social housing is related to the use of water, heat, gas, fuel and electricity. It includes insulation, ventilation, boiler and heating network performance and tenant and energy consumption related to the common space in the buildings.

The energy target of the French energy transition law, published August 18th, 2015, is a 50% reductions of the overall energy consumption by 2050 compared to 2012. Smart metering and heat cost allocation (users pay for what they use) are promoted as stimuli for energy savings. The drivers are prevention, decent housing and affordability. The rationale behind the approach is to offer low price solutions to save energy, rather than often heavy investments in the building itself. Promoted measures include heat leakage detection, smoke detection, monthly billing, pre-payment, humidity control and basic TV/IP/TEL (See Figure 6).

Social Housing in France going Smart

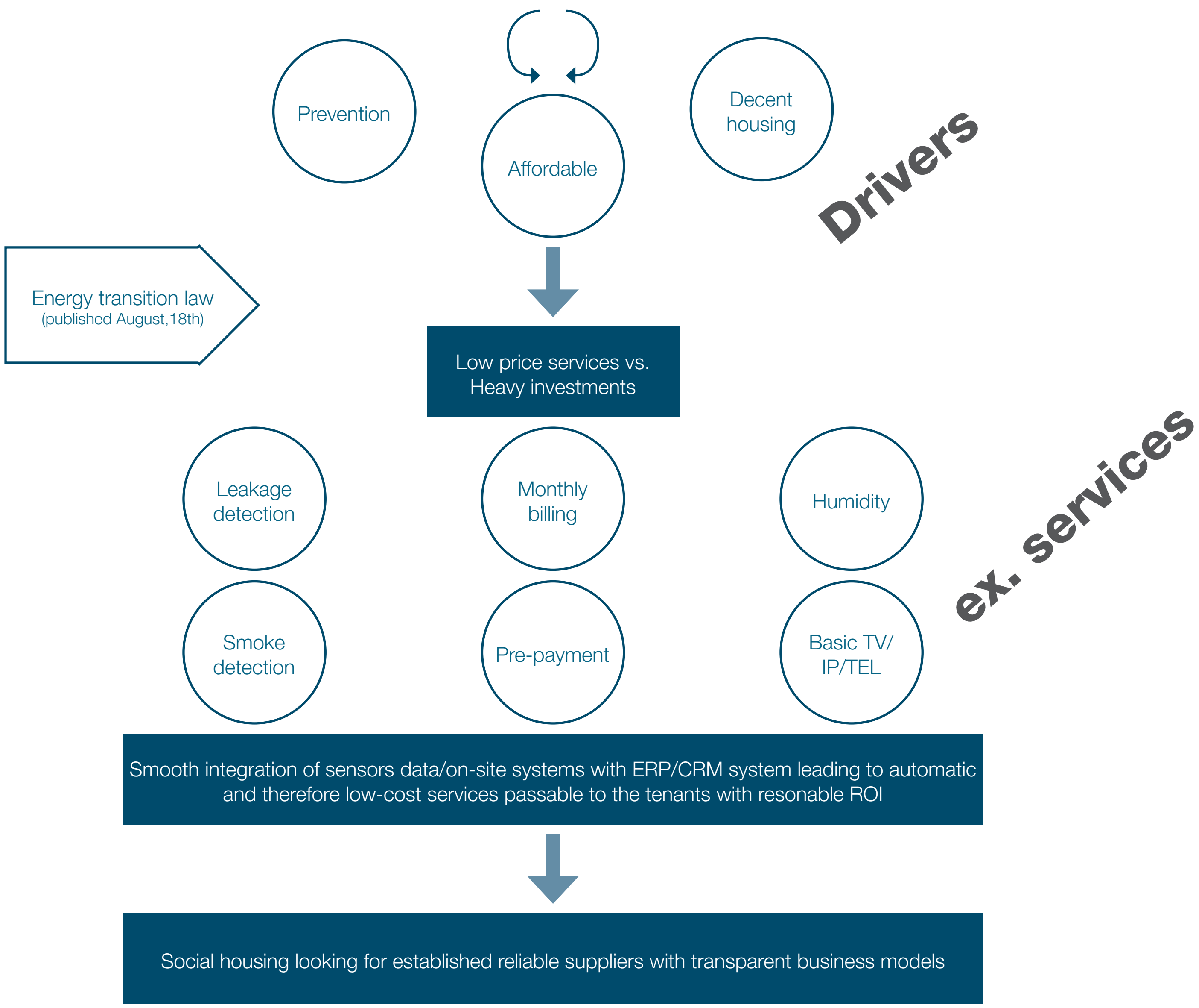


Figure 6 The French energy transition law for social housing in France (ISTA)

An advantage of the monthly payments of end users based on actual energy use of the month is that people are more aware of the costs related to energy. In most countries the energy use is calculated once a year; therefore people are largely unaware of the saving potentials. A lot of low price sub-metering services can be provided to prevent high costs, for example a leakage alert providing information about energy losses caused by leakages. Different kind of measurement and monitoring systems required by the French market were presented by ISTA.

Figure 7 French market requirements about energy management

6. Collecting and operating building data

Nathalie Etien of the French company Intent Technologies introduced the group in **collecting** and operating **building data** as an energy savings lever. Enhancing energy efficiency can be realized by the increase of service level with a constant energy consumption and/or saving energy with a constant service delivery. Energy efficiency levers are presented in Figure 8.

Only effective building design is not sufficient, it must be supported by rational energy management, as presented in figure 9. Management of consumption occurs when the user becomes a conscious actor of his consumption. A user who is becoming an actor of his consumption is not only the “end-user”. The tenant can, for sure, play a role in getting an efficient way of consuming energy. But, his involvement will be largely simplified and durably maintained if the Housing Organisation is leading that change.

When the losses of collective heating will be shared on the bill of tenants who are already equipped with sub metering systems, it will be of bigger impact if the Housing Organisation is also working on its side to manage the collective heating system as efficient as possible. It has been shown that an efficient management of a collective heating system can lead to a 20% decrease of energy needs (Intent Technologies). The proportion is the same as for tenants with sub metering systems, but the quantity of energy is far higher, this is can be seen in figure 10.

Energy Efficiency levers

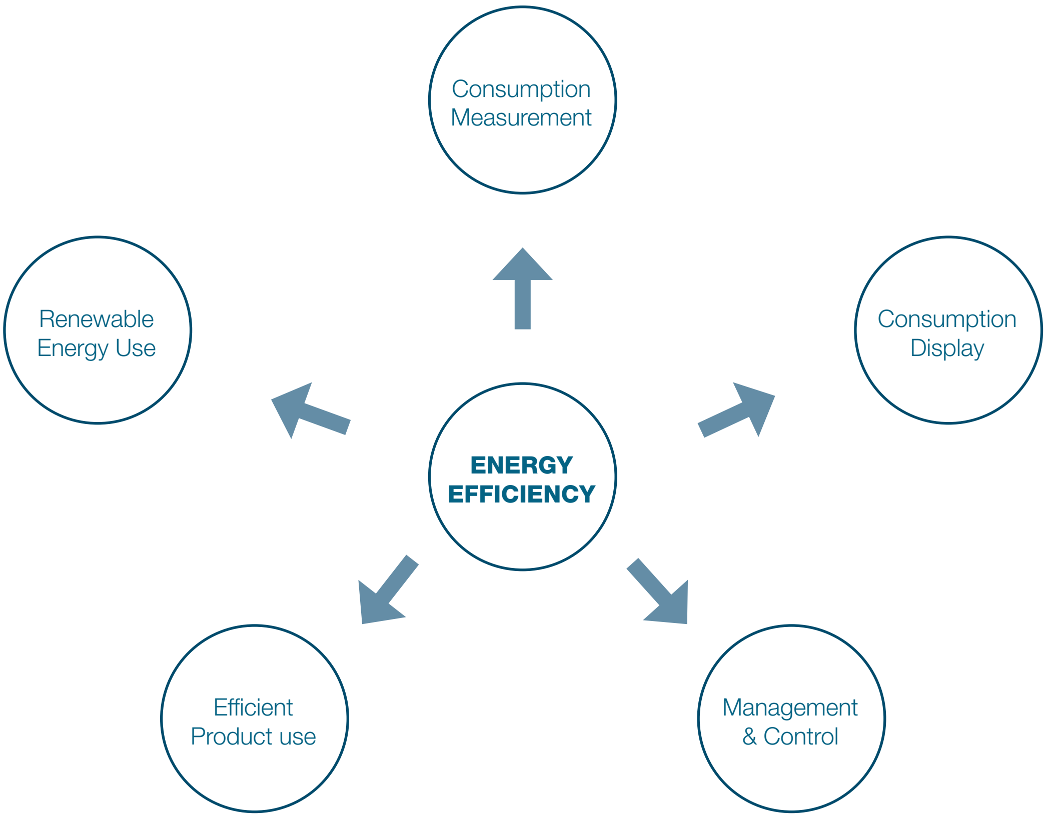


Figure 8 Chart of energy efficiency levers (Source: Intent Technologies)

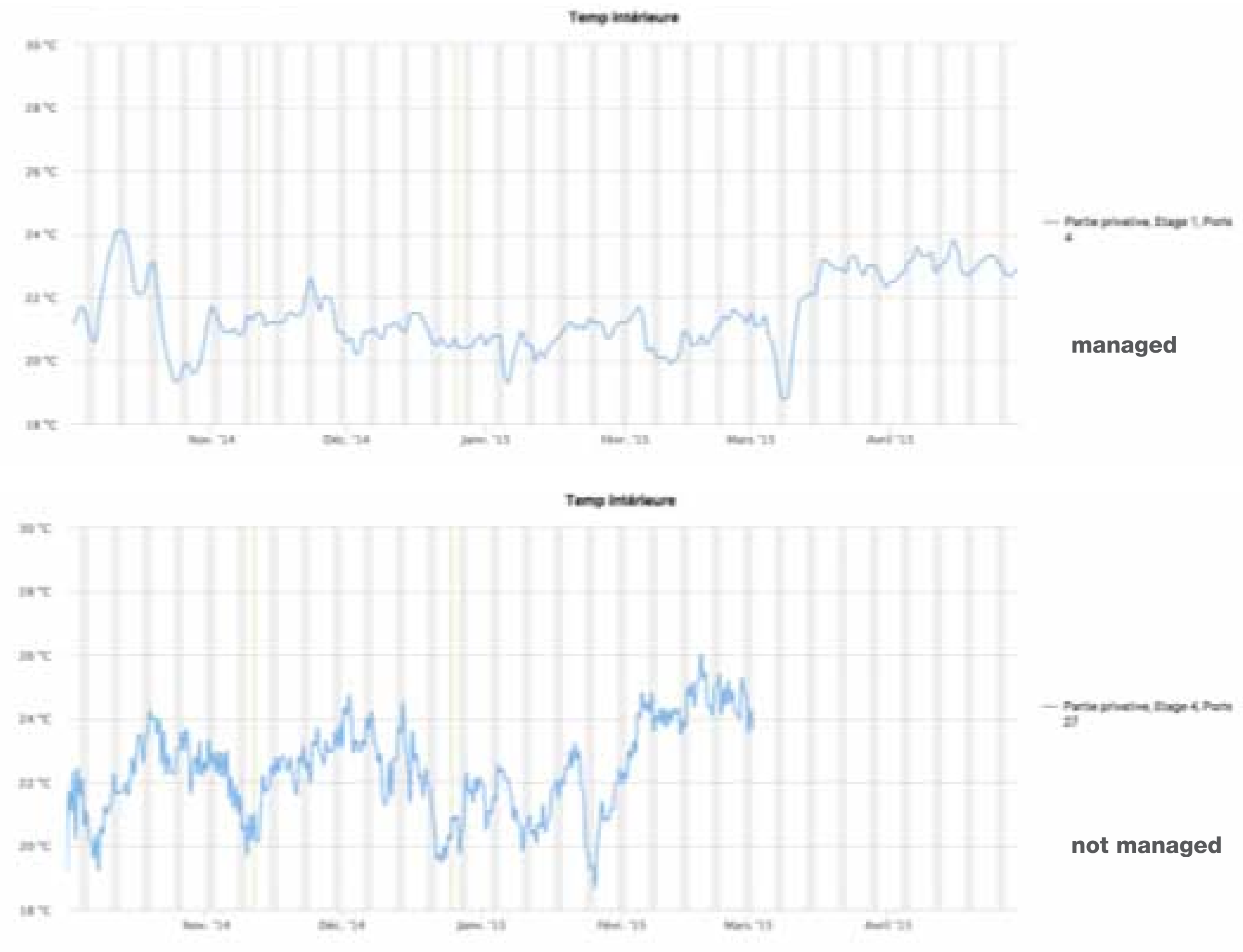
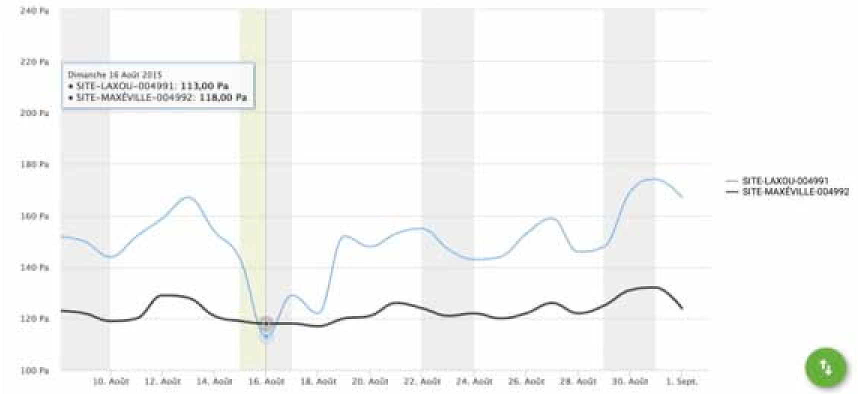


Figure 10 Temperature graphs of buildings where the heating system manager can and cannot access these data (Source: Intent Technologies)

The two temperature curves (figure 10) show an average temperature in a building during the 2014-2015 heating period (October 2014 to April 2015). The two buildings are monitored with temperature sensors (only two sensors implemented at coherent thermal areas). The differences between the buildings, where the heating system manager can and cannot access these data, are presented in table 1.

Table 1 comparison between the buildings where the heating system manager can and cannot access these data, based on the graphs of figure 10.

In the 1st building, the heating system manager **can access** these data.	In the 2nd building, the heating system manager **cannot access** to this feedback system.
• Average temperature is 21°C (comfort contract in France is 19°C + 2) • T° is never lower than 19°C • T° is never higher than 22°C • The start of heating period is clearly seen in October (with a short period – 3 weeks – to reach an efficient management of the system) • The end of heating period is clearly seen early April (with a big decrease immediately followed by high T° 24°C)	• Average T° is 22°C • Lowest T° is 19°C (ok with French contract) • Highest T° is 26°C • The heating period is not traceable



The added value of having **real-time information** on ventilation, temperature, humidity and comfort values is explained. A large deviation from the standard curve can occur for different reasons. In case there is a combination of measurement values available, a good prediction of the cause of a high energy consumption can be made and the possible problem can be solved faster, easier and cheaper than after months of leaking or for example bad ventilation (Figure 11). **Another advantage of real time information** is the possible detection of too much or too little ventilation by the combined information of temperature and humidity. In case of too much ventilation, temperature values will decrease, too little ventilation causes an increase of the humidity values. **Tuning of the ventilation can improve energy** use and prevent problems as a result of too high hygrometry values.

Intent Technologies focusses on the automatic generation of data and the possibility to solve problems that can be identified from the data. Their survey is not focussed on the end consumer being aware of their own consumption. To reach any changes in behaviour the access to information of own consumption is essential but it will only work when users are already motivated. Moreover, 70% of home automation devices are considered as 'anxiety gadgets' because of complex use. For these reasons Intent Technologies does not focus on the end user.

Conclusion viewpoint Intent Technologies: **Personal information is never sufficient to trigger a decision to behaviour change**. The data for the end consumer can be used to support their behaviour but **property management** by the housing company should be used **instead of end user managing**, especially to find problems in houses early and prevent damage caused by late problem solving. A striking different vision from the opinion of ISTA from 'Sub-metering', where the end –user is the main driver behind energy saving.

7. Total plan to reach goals for energy saving is needed

Agnieszka Bogucka of housing company Vilogia mentioned that housing associations needs to do a lot of different investments to get a more sustainable housing stock in the coming 5 years (at least in France). Sub-metering is important in the beginning, but will people stay motivated? The housing associations need to reach their goals for energy savings but at the moment there is no option to choose for only one solution. Instead, the sector needs to combine different instruments although it is very expensive and hard to get an overview of the actual effects. Besides, the price of electricity is low in France which is probably because of hidden costs for nuclear energy, therefore the expectation is that the price will increase in the near future. To reach the imposed regulations on energy saving housing associations need of a total plan with proven results that can be implemented.

8. Business models for energy monitoring

Matthias Hain of Ritterwald presented business models for energy management by housing companies. One of the competences of Ritterwald is to advice in the field of energy management, including reduction of purchasing costs and optimization via transactional approaches. The market potential for energy management is huge. The change in the energy supply industry is being intensified by the political targets that have been issued. The targets issued by EU, Germany's national government and the German states can be found in table 2.

Table 2 targets issued by EU, Germany's national government and the German states

Targets issued by the EU, Germany's national government and the German states

EU	GERMAN GOVERNMENT	GERMAN STATES (e.g. Berlin)
• Significantly greater efforts to increase energy efficiency • The **public sector** has a **pioneering role** to play • **Particularly take existing building stock into account** • Examine the potential for **combined heat and power generation** even at the **local** level • **Expand distributed** combined heat and power generation • Make use of innovative financing mechanisms to **reduce the burden on the public purse** • Especially: **Contracting** • **Especially: Social housing industry**	• **Energy landscape** is in need of **fundamental restructuring** • Exploit the potential for increased energy efficiency • All sectors need to get involved • **Focus: Existing building stock** • If the building envelope is not going to be renovated, then the facilities need to be modernized • Expand **distributed** combined heat and power generation (including into residential housing) • Use **contractors if** doing so will **accelerate** modernization • **CO_2 emissions** to be cut by **40% by 2020** and **80% by 2050 (from 1990 figures)**; **targeted savings** for the residential property industry: **64 m tons of CO_2 p.a. by 2020 and 136 m tons of CO_2 p.a. by 2050**	• **Carbon neutrality** is the goal • Develop innovative and efficient solutions • All sectors and all players need to get involved • **Berlin to become a "combined heat and power generation model city"** • **Contracting** with energy service providers is an important element and is being supported

Market volume for heat and electricity among German GdW members (national federation of housing companies) totals approx. EUR 8.0 bn p.a. – with CO2-emissions of approximately 17 m tons p.a. Energy management for a housing provider can be subdivided into four areas - each with a different value chain (see table 3).

Table 3 overview of energy management: cycle from energy procurement to billing

	1 Basic supply & energy consumption	2 Energy data management	3 Energy controlling/ monitoring	4 Handling of operating costs
Process steps	1 Procurement 2 Operation 3 Consumption	4 Data capture 5 Data reading 6 Data processing	7 Reporting & bench-marking 8 Data review & analysis 9 Planning maint. & modern.	10 Billing operating costs 11 Feedback/customer retention (CRM)
Infra-structure	• Heating systems & storage tanks • Water treatment systems • Combined heat and power plants (CHP) • Photovoltaic/solar thermal systems • Storage reservoirs	a) Individual metering points: • Conventional meters • Smart meters b) Communication units • Data collectors/servers • Data concentration & storage	• ERP system/IT	• ERP system/IT • Portal or traditional billing
Share of costs [%]	3% (internal) / 83% (external)	2% (internal) / 4% (external)	4% (internal) / n.a. (external)	4% (internal) / n.a. (external)
Value chain	• **Heat** • **Electricity**	• **Metering services** • **Smart Metering**	• **Portfolio management**	• **n.a.**

Internal costs External costs

The right courses of action need to be identified for an energy strategy to be successfully implemented. Challenges are:

- Which services are core competencies for a housing provider?
- Which are not and therefore may need to be purchased?
- For which services does the respective housing provider have the critical scale?
- What opportunities and risks are present in the market?
- What legal requirements can be expected/anticipated?
- Are there new service areas or business models that should be considered? Which courses of action are available?

Based on the legal framework new business models arise. Especially in the German Housing market, housing companies increasingly analyse ways of locally generating “green” energy production. Optimizing decentral heating infrastructure can significantly lower CO2-emissions. The course of action of housing providers differ from in-house solutions to transactional approaches (see table 4).

Table 4 Courses of action for housing providers

	IN-HOUSE SOLUTION	TRANSACTION		
	TENDERING	**WHOLLY OWNED SUBSIDIARY**	**51% / 49% PARTICIPATION**	**DIVESTITURE**
DESCRIPTION	• A contract is awarded to a specialized service provider following a tendering procedure	• The contract is awarded to a subsidiary of the group; the subsidiary will provide the services itself	• Valuable long-term contracts are brought into a participation with a contractor	• Subsequent sale of a subsidiary/participation
NOTABLE FEATURES FOR THE PARENT COMPANY	• Minimizes the ongoing costs of service provision while ensuring quality	• No tendering procedure • Reports directly to the group	• The percentage participation depends on various factors • Reduces ongoing costs for the principal, brings synergies/economies of scale for the contractor	• Immediate cash-in effect • Reduces ongoing costs for the principal • Synergies/economies of scale for the contractor
EVALUATION/ OUTCOME	• Flexible approach • Relatively easy to switch service provider	• Control over and access to the service provider • Profit participation	• Less control over the service provider • Partial profit participation + one-time effect	• No control over the service provider • One-time effect from the sale proceeds

Depending on the size of the own rental stock different strategic options arise to implement local energy production strategies. The course of action of housing providers depends on the size and structure of the portfolio (See Figure 12). If the amount of units is below 5.000, partnering with market experts is a possible course of action (e.g. a joint venture). Between 5.000 and 20.000 units the in-house/partnering is possible and above 20.000 it will be the in-house solution. In-house solution for housing companies means implementing an own energy providing subsidiaries. The subsidiary then offers portfolio contracting services by optimizing the heating systems and modernising the heating systems as well establishing power-to-heat generation. The substance of the portfolio also matters, new build or historic stock and the technical systems already fitted.

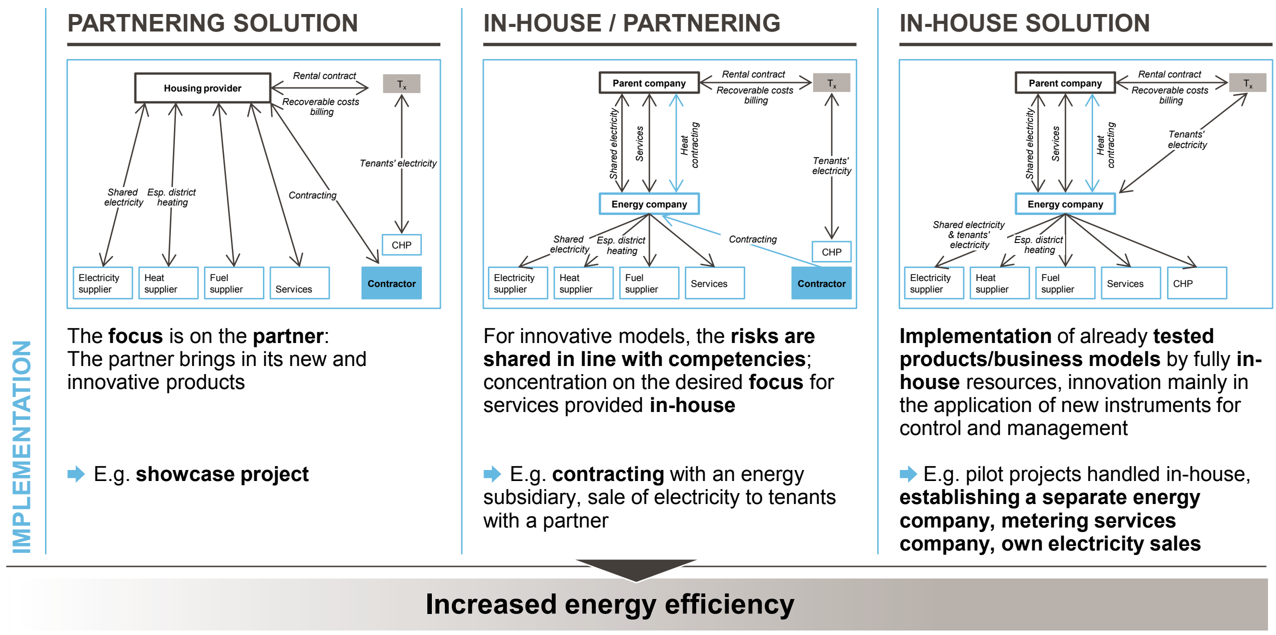


Figure 12 Possible business models in the energy segment

9. Running projects

TRIME

Trias Mores Energetica (TRIME) is a pan-european project that engages social housing residents across Europe to motivate them to save energy and save money on their energy bills through behaviour change. The goal of the project is to achieve long -term increased energy efficiency in existing housing and increase of welfare and health. TRIME runs in 5 countries (UK, France, Spain, the Netherlands and Belgium) for 3 years (2014-2017). The work is co-funded by the European Union.

Aims

- 3,875 residents across 7 TRIME pilot sites to get advice from Energy Ambassadors about reducing their energy consumption and facilitating a 9% energy saving through behaviour change.
- Saving 2 GWh through residents replacing household appliances.
- An additional 2 GWh saving through 200 households renting energy efficient appliances.
- TRIME Partners to retrofit 1,000 homes with energy efficiency improvements saving 2.4 GWh.
- 20 additional social housing organisations will encourage 1,250 of their residents to change their behaviour and reduce their energy consumption by 9%.

Latest News

- Each Housing Association will recruit Energy Ambassadors, these are volunteers that will receive training about how to save energy in their home and they will then share this information with residents living in their local area. The Energy Ambassadors will help other residents to reduce their energy consumption and save money on their energy bills by changing their behaviour and how we think about energy.
- Monitoring of a small number of people will take place to see how they use appliances in their home and if they understand how much energy these appliances use. We hope to be able to understand how people use these appliances and if there are some simple messages that can help people to save energy in their home.
- A TRIME competition that will span 5 countries and encourage over a 1,000 households will be developed to save energy and money on the household energy bills.
- One of the key things for TRIME is to share learning and best practice with other organisations – you can find all our resources on the TRIME website - http://www.trime-eu.org

EFL Low Carbon House

Some partner housing associations of EFL had the wish to develop a joint EFL Low Carbon House. Keoto, associated member of the EFL, is an integral planning company supported by the latest research activities of ETH Zurich. Keoto seeks to define construction guidelines that could be implemented by EFL partners across Northern Europe, as demanded by EFL's Low Carbon House. KEOTO is working on diverse typologies for England, the Netherlands and Germany.

10. Presentations and participants Essen Meeting

The sheets of the presentations that were given on the meeting in Essen and of which an overview is given in table 5, can be found on the EFL website; in the member area of the website under the tab documents in the folder EFL Topic Groups in the group Energy efficient housing in the folder 9 9 2015 Essen. The participants of the meeting in Essen can be found in figure 13.

Table 5 Overview presentations given on the meeting in Essen

PRESENTATION GIVEN BY		SUBJECT
Ritterwald	Mathias Hain	Business models for energy management
TU Delft – OTB Research	Laure Itard	Actual Energy Use in Dwellings
ISTA	Dario Cohen	Energy Management in Social Housing Based on French examples
ISTA	Ulrich Fischer	Energy Efficiency in buildings Effects of sub-metering
TU Delft – OTB Research	Henk Visscher	Insights in houshold energy use
Intent Technologies	Nathalie Etien	Collecting and operating building data

1. Joost Nieuwenhuijzen (NL)	EF-L	7. Viktor Grinewitschus (D)	EBZ	13. Laure Itard (NL)	TU Delft - OTB Research
2. Ulrich Fischer (D)	ISTA	8. Paul Martin (UK)	MOAT	14. Mariya Museva (D)	Ritterwald
3. Mathias Hain (D)	Ritterwald	9. André Heheman (NL)	Van der Leij Groep	15. Agnieszka Bogucka (FR)	Vilogia
4. Lara Hayim (UK)	Circle	10. Pierre Touya (FR)	Polylogis	16. Cristophe Conqui (FR)	ISTA
5. Dario Cohen (D)	ISTA	11. Henk Visscher (NL)	TU Delft - OTB Research	17. Rolien Wisse (NL)	EF-L
6. Heinwillem de Boer (NL)	Vastbouw	12. Nathalie Etien (FR)	Intent Technologies	18. Laurie Espinosa (FR)	ICF Habitat

Figure 13 Participants of the meeting in Essen, September 9, 2015

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