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Analysis of Member States' rules for allocating heating, cooling and hot water costs in multi-apartment/purpose buildings supplied from collective systems

*Implementation of
EED Article 9(3)*

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Abstract

Energy savings achieved through the introduction of metering and billing of individual consumption of heating/cooling and domestic hot water in multi-apartment and multi-purpose buildings with collective supply systems for these services can make a contribution achieve the energy efficiency targets of the EU in 2020 and beyond.

The Energy Efficiency Directive (EED) is the cornerstone of the legal framework for accurate metering and billing of individual consumption of heating/cooling and domestic hot water in multi-apartment and multi-purpose buildings in the EU. It requires the introduction of consumption-based cost allocation and informative, billing of heating, cooling and hot water in multi-unit buildings, subject to certain conditions. Individual metering and billing allows sharing the energy costs among the occupants of multi-apartment buildings taking into account indicators reflecting their individual, actual energy consumption. It provides occupants with an economic incentive to change behaviour and save energy and hot water, as opposed to situations where energy costs are allocated exclusively according to factors that cannot be influenced by the occupant, such as the size of the dwelling, etc.

The purpose of this report is to provide a systematic overview of the existing thermal cost allocation rules in Member States, characterising them in terms of key features. This features include any permitted or recommended ranges of the share of variable costs allocated according to readings from individual metering devices, use of correction factors related to a flat's location in the building, minimum and maximum thresholds for deviations from the average bill, penalties etc.

The outcome of this report might contain useful information and references for any Member States that are designing or revising thermal energy cost allocation rules.

1 Introduction

Today the European building stock consumes approximately 40% of primary energy and it is responsible for 36% of the EU greenhouse emissions¹. A significant reduction of building energy demand is a requisite to meet Europe's GHG emissions reduction targets².

Energy savings achieved through the introduction of metering and billing of individual consumption of heating/cooling and domestic hot water in multi-apartment and multi-purpose buildings supplied from a central source can make a contribution to the scaling up of efforts to achieve the energy efficiency targets of the EU in 2020 and beyond.

The Energy Efficiency Directive (EED) [1] is the cornerstone of the legal framework for accurate metering and billing of individual consumption of heating/cooling and domestic hot water in multi-apartment and multi-purpose buildings in the EU. It requires the introduction of consumption-based cost allocation and informative billing of heating, cooling and hot water in multi-unit buildings, subject to certain conditions. Individual metering and billing permit a fairer system of repartition of the energy costs among the occupants of multi-apartment buildings based on actual energy consumption rather than estimation done according to the size of the dwelling, etc.

The general idea behind EED provisions is to ensure that energy consumers in such buildings have the right incentives and sufficient information to adopt energy-efficient behaviours.

Where individual meters or heat cost allocators are available, readings from such devices can be used for the purpose of allocating the building's total energy costs to the individual units. In this context Article 9 (3) of the EED provides the following³:

Where multi-apartment buildings are supplied from district heating or cooling, or where own common heating or cooling systems for such buildings are prevalent, Member States may introduce transparent rules on the allocation of the cost of thermal or hot water consumption in such buildings to ensure transparency and accuracy of accounting for individual consumption. Where appropriate, such rules shall include guidelines on the way to allocate costs for heat and/or hot water that is used as follows:

- a) hot water for domestic needs;*
- b) heat radiated from the building installation and for the purpose of heating the common areas (where staircases and corridors are equipped with radiators);*
- c) for the purpose of heating apartments.*

The purpose of this report is to provide a systematic overview of the existing thermal cost allocation rules in Member States, characterising them in terms of key features. This features include any permitted or recommended ranges of the share of variable costs allocated according to readings from individual metering devices, use of correction factors related to a flat's location in the building, minimum and maximum thresholds for deviations from the average bill, penalties etc.

The outcome of this report might contain useful information and references for any Member States that are designing or revising thermal energy cost allocation rules.

¹ <https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings>

² COM/2014/015 final

³ On 30 November 2016, the European Commission presented a proposal for the review of the EED including certain aspects of Articles 9-11 and Annex VII. One of the proposed changes is to make mandatory the publication of transparent rules on the allocation of the cost of thermal or hot water consumption by Member States. In the new version of the current EED Article 9 (3) the Commission proposed that the word "May" be substituted with "Shall": "... Member States shall introduce transparent rules on the allocation of the cost of thermal or hot water consumption..."

2 Analysis of the existing allocation rules

According to our analysis, 16 Member States (out of 28) introduced rules at national level on the allocation of space heating or hot water consumption in multi-apartment buildings supplied from a central heating system (see Table 1 and Figure 1).

Table 1. Status of the introduction of thermal cost allocation rules in EU

Member State	Thermal cost allocation rules
Austria	Defined
Belgium	Not defined
Bulgaria	Defined
Croatia	Defined
Cyprus	Not defined
Czech Republic	Defined
Denmark	Defined
Estonia	Defined
Finland	Not defined
France	Defined
Germany	Defined
Greece	Not defined
Hungary	Defined (for District Heating only)
Ireland	Not defined
Italy	Defined
Latvia	Defined
Lithuania	Defined
Luxemburg	Not defined
Malta	Only a general framework in place
Netherlands	Defined
Poland	Only a general framework in place
Portugal	Not defined
Romania	Defined
Slovakia	Defined
Slovenia	Defined
Spain	Not defined
Sweden	Not defined
UK	Only a general framework in place

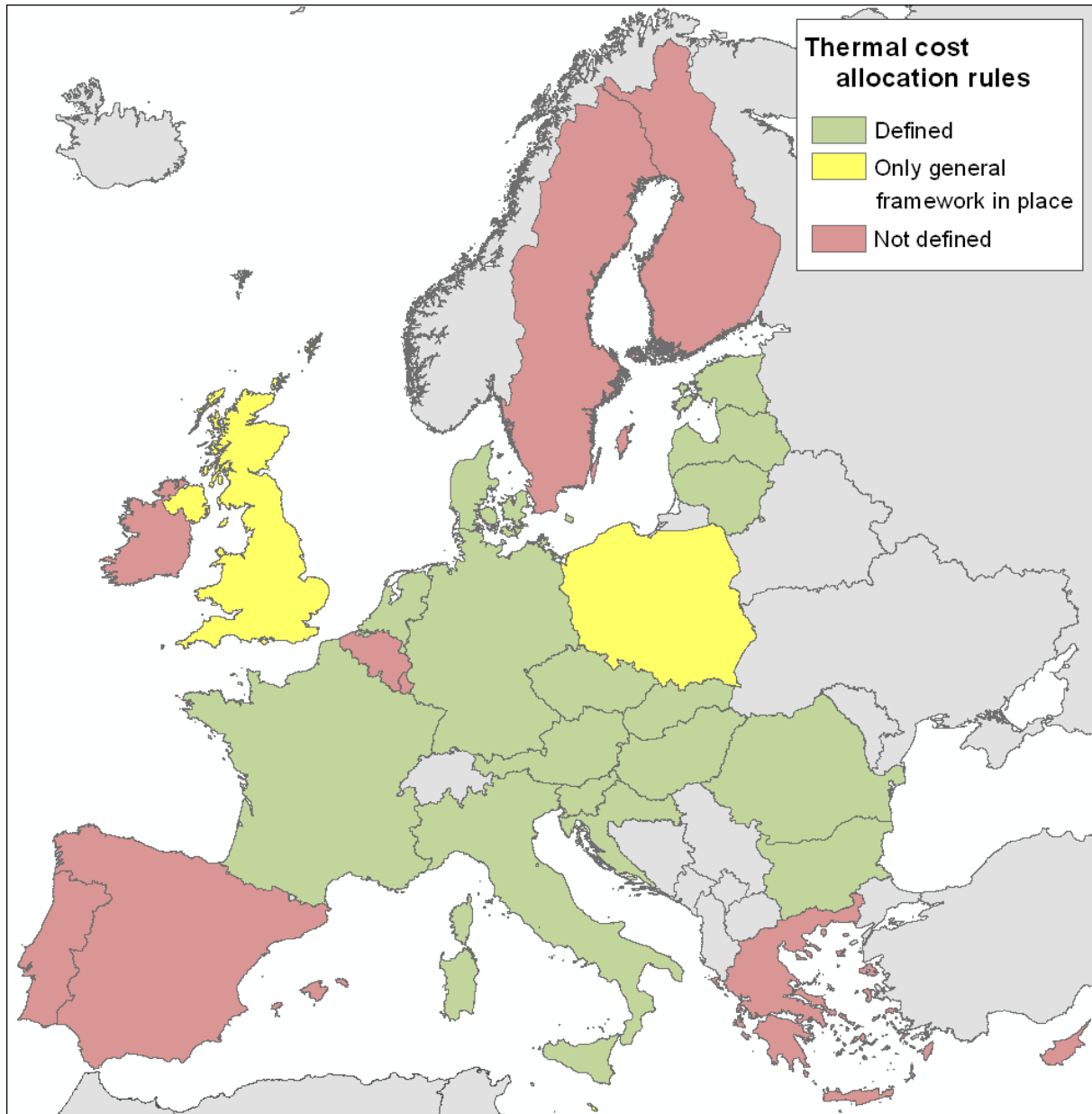
This overview is the result of the analysis of documents from a variety of different sources (e.g. relevant national legislation acts, MBIC workshop presentations⁴, empirica GmbH Guidelines⁵, data from experts). Member States authorities were consulted on a draft version of this analysis.

⁴ <http://mbic.eu/workshops.html>

⁵ https://ec.europa.eu/energy/sites/ener/files/documents/mbic_guidelines20170123_en.pdf

The level of details of the information available varies considerably among Member States and for a more detailed analysis of national rule provisions, an official translation of key relevant national legislative acts would be necessary⁶.

Figure 1. Status of the introduction of thermal cost allocation rules in EU



In this section the thermal allocation rules identified are analysed and characterised in term of key features.

In the analysis the following aspects have been taken in to account:

- Permitted/recommended range of the share of variable and fixed costs of thermal energy provision; both for space heating and domestic hot water (DHW) preparation;

⁶ For this preliminary analysis, in the majority of cases a machine translation tool has been used for translating the key legislative acts from the original languages into English

- Use of correction factors;
- Use of minimum and/or maximum individual heat cost thresholds;
- Building common area cost allocation rules;
- Use of default values or penalties for individual tenants/occupants to discourage denial of access to meter readers, tampering etc.

The following table (Table 2) summarise the Space heating/cooling and hot water allocation rules identified in Member States. As a general comment, more information on space heating cost allocation rules are available than on DHW. Moreover, no space cooling allocation rules details were found, with the exception of EE and DK.

Table 2. Overview of space heating/cooling and hot water allocation rules in MS

Member State	Allocation rules		
	Space heating	Cooling	Hot water
AT	Yes	No	Yes
BG	Yes	No	Yes
CZ	Yes	No	Yes
DE	Yes	No	Yes
DK	Yes	Yes	Yes
EE	Yes	Yes	Yes
FR	Yes	No	Yes
HR	Yes	No	Yes
HU	Yes	No	Yes
IT	Yes	Foreseen but not fully defined	Yes
LT	Yes	No	Unclear
LV	Yes	No	Yes
MT	Foreseen but not fully defined		
NL	Yes	No	Yes
PL	Yes	No	Unclear
RO	Yes	No	Unclear
SK	Yes	No	Yes
SI	Yes	No	Yes
UK	Foreseen but not fully defined		

2.1 Variable and fixed costs of thermal energy provision

The expenses for building space heating, space cooling and domestic hot water can be divided into variable and fixed costs.

The "variable costs" are the ones which can vary with the external climatic conditions and with changes in the building users' behaviour (e.g. more energy conscious habits, such as avoiding having windows open while heating, reducing the temperature of the dwelling when or where possible, saving hot water etc) and are essentially related to the cost of fuel or other source of energy for providing heating, cooling or domestic hot water. This is the fraction of the expenses that the introduction of an individual cost allocation scheme can help to reduce and which are usually allocated according to individual energy consumption readings (obtained from individual meters or heat cost allocation devices).

The "fixed costs" are the ones that are substantially independent from the amount of thermal energy provided over a period and from the users' behaviour (and climatic conditions) and generally include the expenses for:

- Heating/cooling system maintenance and operating costs (e.g. emission testing, including chimney sweeping etc);
- network access fixed charges e.g. for district heating;
- Energy for ancillary equipment such as circulation pumps, fans, control systems etc;
- Energy metering and cost allocation service.

Fixed costs are usually distributed among the users in proportion to the size of the properties (e.g. floor area or volume).

Special cases of costs, not so easy to categorize into fixed and variable, are the ones related to thermal energy losses of poorly insulated pipe-work within a building and the consumption/expenses related to common area and facilities. These costs, although they affect the amount of fuel consumed (and thus the variable costs), are not directly controlled by user behaviours, and are usually treated in the analysed national cost allocation frameworks as fixed cost.

A definition of the type of fixed and variable costs considered to be heating costs is normally specified in national regulations.

The method of allocation of costs may be specified in national legislation or can be free of regulation, subject only to contractual agreement between landlord and final customer or mixed.

The share of costs allocated based on consumption is a parameter that can be of importance both to the effectiveness and the perceived fairness of a cost allocation scheme. On other hand, the introduction of cost allocation schemes with a significant variable consumption-based component (e.g. 50% - 70%) is key for achieving significant energy savings through the behavioural changes targeted by the metering provisions of the EED. Without sufficient scope to influence their bills, individual occupants will have limited incentive to adopt energy-efficient behaviours.

On the other hand, cost allocation rules should also somehow reflect that individual units in multi-apartment buildings are not thermally entirely independent of each other, as internal walls are rarely well insulated, there are un-voluntary heat consumptions (e.g. distribution system losses, heating of common areas etc) and individual consumption measurements can be influenced by other tenants heating behaviour. For this reason, in a well-designed cost allocation scheme, a fixed heating cost quota and/or correction factors is introduced.

Usually the fixed quota, substantially independent from users' behaviour, is set in the 30–50% range, but in some specific cases (e.g. some Eastern countries) it can be higher.

In the following Table 3 and Figure 2, an overview of the permitted ranges of the share of variable and fixed space heating costs in Member States is presented.

Table 3. Permitted ranges of the share of variable/fixed space heating costs

Member State	Variable share	Fixed share
AT	min 55% - max 75% (65% if no agreement)	min 25% - max 45% (35% if no agreement)
BG	on the basis of individual heat meters readings	The heating system heat losses are divided on m ²
CZ	min 50%-max 70%	min 30% - max 50%
DE	min 50%-max 70%	min 30% - max 50%
DK	>40% of total heating costs (including DHW) >60% if only space heating is considered	<40% of total heating costs (including DHW) <60% if only space heating is considered
EE	Range of variable cost is not specified in the legislation, but typically is between 40% and 60%	Not specified in the legislation, but typically is between 60% and 40%
FR	70%	30%
HR	unclear	unclear
HU	min 50%-max 70%	min 30% - max 50%
IT	voluntary heat consumption	un-voluntary heat consumption
LT	Unclear	Unclear
LV	Unclear	Unclear
NL	There is no limit set for the share of variable and fixed costs. There is a maximum set for the fixed costs and a maximum for the prices per delivered GJ of heat.	
PL	under discussion	under discussion
RO	40% (under discussion)	60% (under discussion)
SI	min 50% - max 80%	min 20% - max 50%
SK	40%	60%

According to our analysis, the majority of Member States, introduced cost allocation schemes with a significant (e.g. 50%-70%) variable consumption based share. This is in line with the current evidence base is that saving effects have been shown in cases where a significant proportion of costs have been allocated based on measured consumption. In some Eastern Countries (i.e. RO, SK, PL⁷), the share of fixed costs are higher than the average ($\geq 60\%$). This can be in part explained by the specific climatic⁸ and building stock conditions in these countries (e.g. higher average heating distribution system energy losses, limited individual heating control devices⁹). Nevertheless,

⁷ In Poland there is a strong debate on which minimum share of fixed cost shall be used and the values under discussion are quite high (55-90%). A legal court decision in Bialystok stated that if a residential building has no thermostatic valves, the fixed fee must be at least 90%.

⁸ Expert analyses in Slovenia show that an apartment consumes, on average, 60% of the heat just to be heated up to the minimum temperature of 14°C in the heating season, which also prevents excessive cooling of, and damage to, the structure of the building.

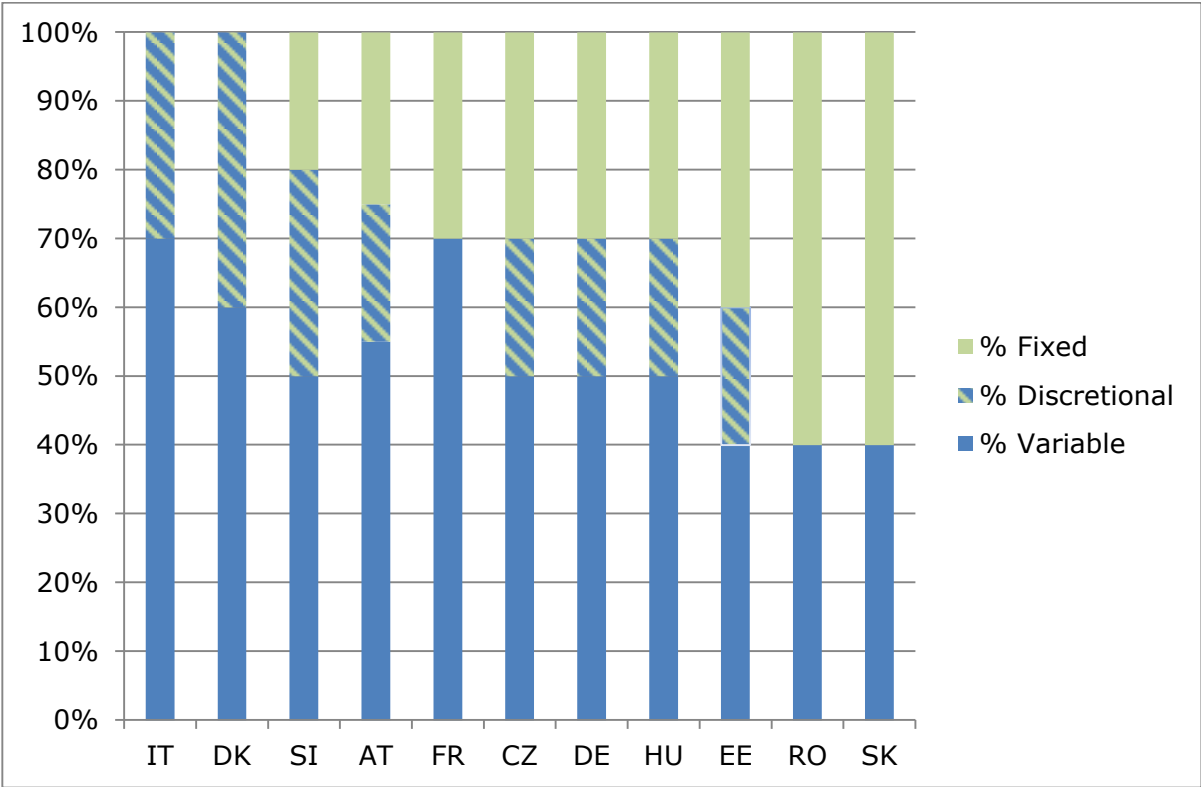
⁹ E.g. in Poland a court decision set the fixed quota to 90% in multi-apartment buildings where thermostatic valves were not installed.

allocation rules with a consumption based cost share lower than 30% risk providing insufficient incentives for energy efficient behaviour and can limit the reduction of energy consumption in multi-apartment buildings.

Some Member States (i.e. AT, CZ, DE, DK, EE, HU, IT, NL and SI) allow for some flexibility in the choice of the distribution of variable/fixed costs (e.g. depending on dwelling size and level of consumption), that can be agreed, case by case, between landlord and occupants.

Other Member States, e.g. IT and BG, use a different approach, dividing the heating expenses on the base of *voluntary consumptions* ("variable quota"), measured with meters, and *non-voluntary consumption* (or "fixed quota"), independent to user actions (e.g. heat losses of the distribution network); the share of variable and fixed costs is thus calculated case by case per each building. On one hand this approach may be seen as more objective, but on the other hand this method is more complex than the others and, for the Italian case, requires a building energy audit to be implemented by an energy expert.

Figure 2. Permitted ranges of the share of variable/fixed space heating costs



The same analysis has been performed for the cost allocation rules for the preparation of domestic hot water. The results of this analysis are presented in Table 4 and Figure 3.

In the majority of Member States analysed (i.e. AT, DK, FR, DE, HU, IT, SI) the same cost allocation principle used for space heating applies to hot water consumption.

In some cases, less flexibility is given in the choice of the variable/fixed shares (i.e. CZ) and the "variable cost" portion in DHW cost allocation schemes is higher than in the space heating ones (i.e. CZ and SK). This most likely because in the case of DHW building distribution systems there tends to be more direct link between individual and overall consumption than in space heating (e.g. due to space heating transfer between flats, heating of common areas etc).

Table 4. Permitted ranges of the share of variable/fixed Domestic Hot Water costs

Member State	Consumption share	Fixed share
AT	min 55% - max 75% (65% if no agreement)	min 25% - max 45% (35% if no agreement)
BG	Based on readings of heat meters. If DHW meters not installed consumers are charged with a "140 litres hot water flat rate" per day per person fee	
CZ	70%	30%
DE	min 50%-max 70%	min 30%-max 50%%
DK	>40% of total heating costs (including DHW)	<40% of total heating costs (including DHW)
EE	Cost distribution rules are not specified in the legislation. Typically, a part of costs is based on DHW meter readings. When the space heating system is turned on in a building, costs are calculated based on meter readings. Otherwise, costs arising from DHW system heat losses are added on top of that. These costs are distributed in proportion to the area of the properties.	
FR	70%	30%
HR	If individual DHW meters installed, DHW cost is distributed as per measured consumption. If not installed, costs distributed according to number of flat occupants	
HU	min 50% - max 70%	min 30% - max 50%
IT	voluntary heat consumption	un-voluntary heat consumption
LT	Unclear	Unclear
LV	Unclear	Unclear
NL	The law regulates space heating and domestic hot water. Normally they are delivered together. If they are measured separately the sum of the fixed prices for space heating and domestic hot water should not be more than the regulated maximum for the fixed price. The maximum price for the delivered heat in GJ applies for both space	
PL	Unclear	Unclear
RO	Unclear	Unclear
SI	min 50%-max 80%	min 20% - max 50%
SK	80%	20%

Less information on domestic hot water preparation cost allocation schemes in comparison with space heating ones were found and the rules used in LV, LT, PL and RO are unclear¹⁰.

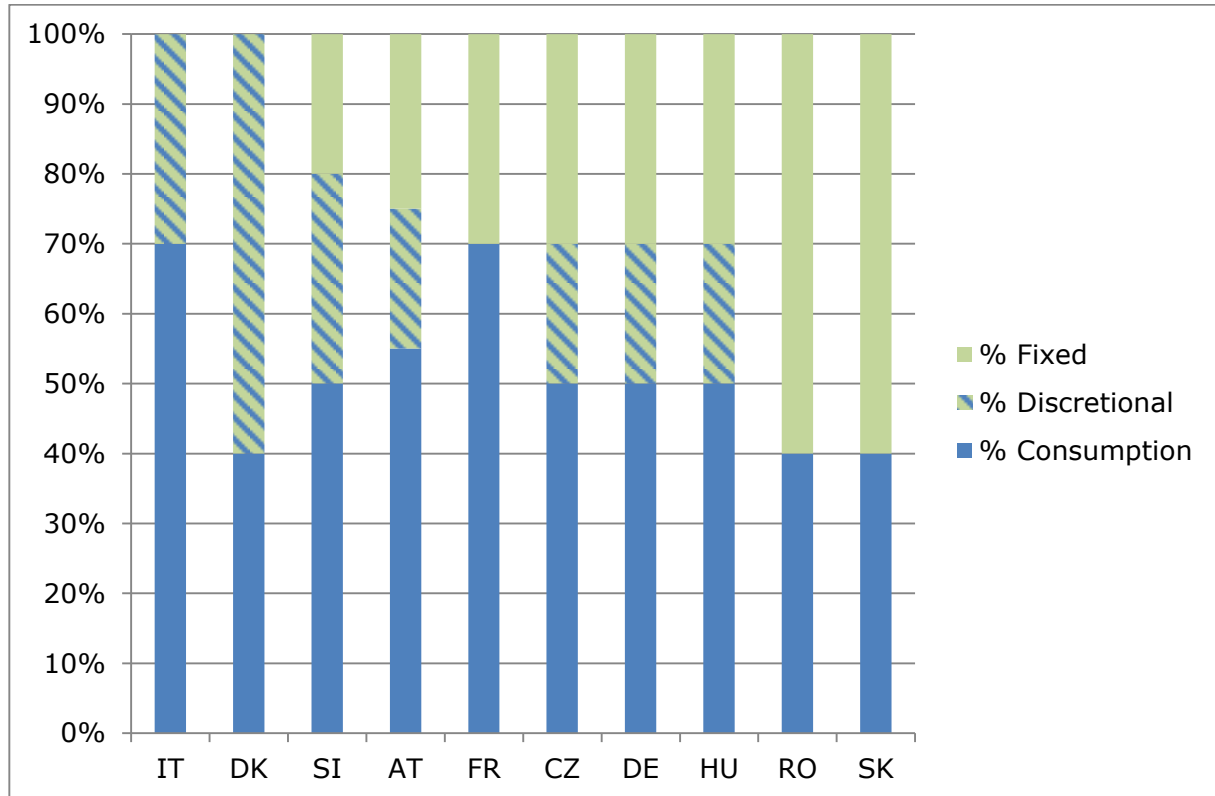
In all Member States, the installation of a specific meter for hot water is recommended.

¹⁰ An official translation of this countries regulation documents is necessary to have a clear picture of their legal framework

In case it is not installed, costs are allocated according to the number of occupants:

- In Bulgaria, consumers are charged with a "140 litres hot water flat rate" per day per person fee;
- In Croatia, DHW costs are distributed according to the number of occupants of every apartment in relation to the total number of tenants in the building.

Figure 3. Permitted ranges of the share of variable/fixed Domestic Hot Water costs



2.2 Use of correction factors

In a multi-apartment building, some dwellings may naturally be colder because of their unfavourable location (e.g. located under the roof, over an unheated parking space, at the corner of the building, oriented north, etc.). Moreover, due to absence of thermal insulation between adjacent apartments, thermal energy can fairly easily flow between the apartments. Therefore, the individualisation of heating cost might not be perceived as fair if based exclusively on individual meter/heat cost allocator readings.

There is therefore often a question arising about the need to have corrective measures in the billing system and different countries apply diverse approaches to this heat cost allocation aspect (e.g. use of specific correction coefficients, the share of overall costs allocated based on readings, the use of minimum and maximum limits for the share of costs allocated to an individual unit etc).

The result of our analysis on the use of correction factors in Member States' cost allocation rules is presented in Table 5 and Figure 4.

Table 5. Use of correction factors in Member States thermal cost allocation rules

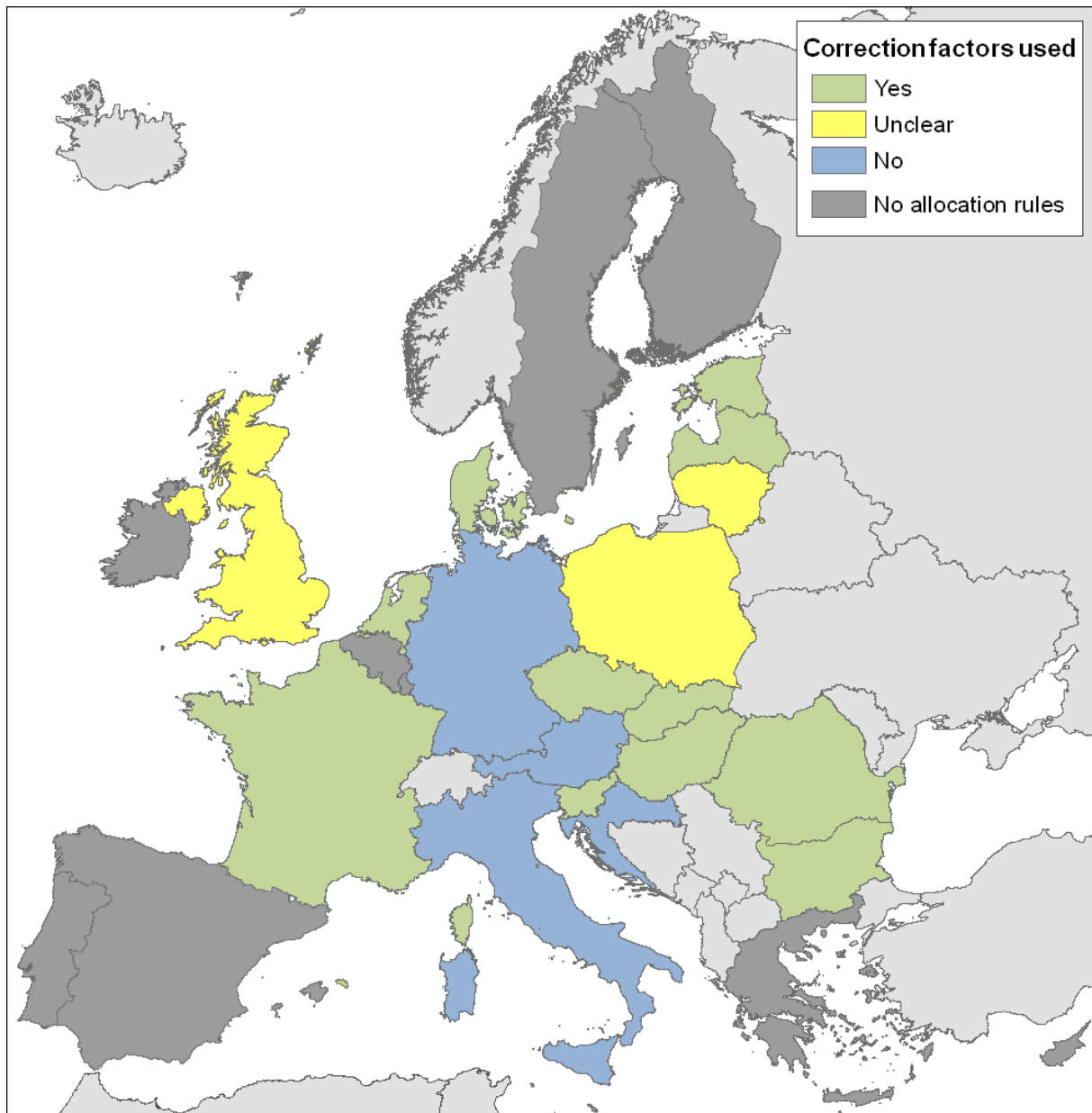
Member State	Correction factors used	Note
AT	No	Forbidden
BG	Yes	They are allowed, but de facto rarely used
CZ	Yes	Mandatory
DE	No	Forbidden
DK	Yes	Mandatory
EE	Yes	Correction factors are used dominantly, but they are not required in legislation
FR	Yes	Agreement of the general assembly of the co-owners required
HR	No	
HU	Yes	Calculated per every room
IT	No	Forbidden
LT	Yes	Mandatory
MT	Unclear	
LV	Yes	Calculated for each building by an independent expert
NL	Yes	In the new heating law they will be allowed
PL	Unclear	
RO	Yes	Calculated per every room
SI	Yes	Calculated for each building by an independent expert
SK	Yes	Unclear if mandatory
UK	Unclear	Not regulated

The use of correction factors for the allocation of heating costs in multi-apartment buildings is mandatory in Denmark, Czech Republic and Lithuania, it is forbidden in Austria, Germany and Italy, while in France and Poland their application is voluntary¹¹.

Correction factors can be calculated per flat or per every single room, as in the Romanian and Hungarian case. Moreover, some Member State provides in the legislation the correction factors in specific tables (e.g. RO), taking into account the position of the building unit, in others they are calculated for each building by independent energy experts (e.g. LV, SI).

¹¹ For HU, LV, RO, SK, SI it is unclear if the use of correction factors is mandatory or voluntary

Figure 4. Use of correction factors in Member States thermal cost allocation rules



The choice of proper correction factors can also have an impact on the decision process on major building renovation measures. For instance, in the case of the renovation of the envelope of a multi-apartment building, the owners of the least energy performing apartments (e.g. at the top floor, north oriented, etc) may be in minority in the decision making of the refurbishment. The introduction of billing correction factors can contribute to solving this adverse effect and to ease the transition from a centralized to an individual energy consumption accounting system, or reduce the risk that individual metering and billing becomes an obstacle for taking optimal decisions at building level about refurbishments etc.

On the other hand, the use of poorly defined corrective coefficients (e.g. that compensate too much the different consumption of tenants) can significantly reduce the benefits expected from behavioural changes and consumers can be less incentivised to reduce their energy consumption. These aspects should be taken into account when correction factors are defined in Member states.

2.3 Use of minimum and/or maximum individual heat cost limits

In some Member States, following the introduction of individual thermal cost allocation rules in multi-apartment buildings, it happened that certain residents in some cases were keeping all the radiators in their apartment turned off for the whole heating season and thus exclusively relying on passive heating from heated neighbouring apartments flowing through the walls, floors and ceilings¹²; by saving excessively in this way, these residents therefore created additional costs for their neighbours.

In order to address this issue, some Member States (e.g. CZ, HU, SI) introduced in their regulations minimum and maximum limits to the share of cost allocated to an individual unit (see Table 6 and Figure 5).

Table 6. Use of minimum and/or maximum individual heat cost limits in Member States

Member State	Use of minimum and/or maximum thresholds
AT	No
BG	Unclear
CZ	Costs of none of the tenants can exceed 200% or be lower than 80% of the building average costs
DE	No
DK	No
EE	No
ES	Unclear
FR	No
HR	Unclear
HU	Max. share of heating costs limited to 250% of the building average
IT	No
LT	No
LV	No
PL	Unclear
MT	Unclear
RO	Unclear
SI	Maximum share of heating costs limited to 300% of the average; Minimum level of consumption is 40% of the average
SK	Unclear
UK	No

In practice, when consumption shares based on cost allocator/heat meters readings are established, any consumption shares that are below the minimum of the average per m² (e.g. 40% in the Slovenian case), are increased to the set minimum, whereas any consumption shares that exceed the maximum of the average per m² (e.g. 300% in SI) are reduced to this maximum. In this way, owners rely exclusively on passive heat

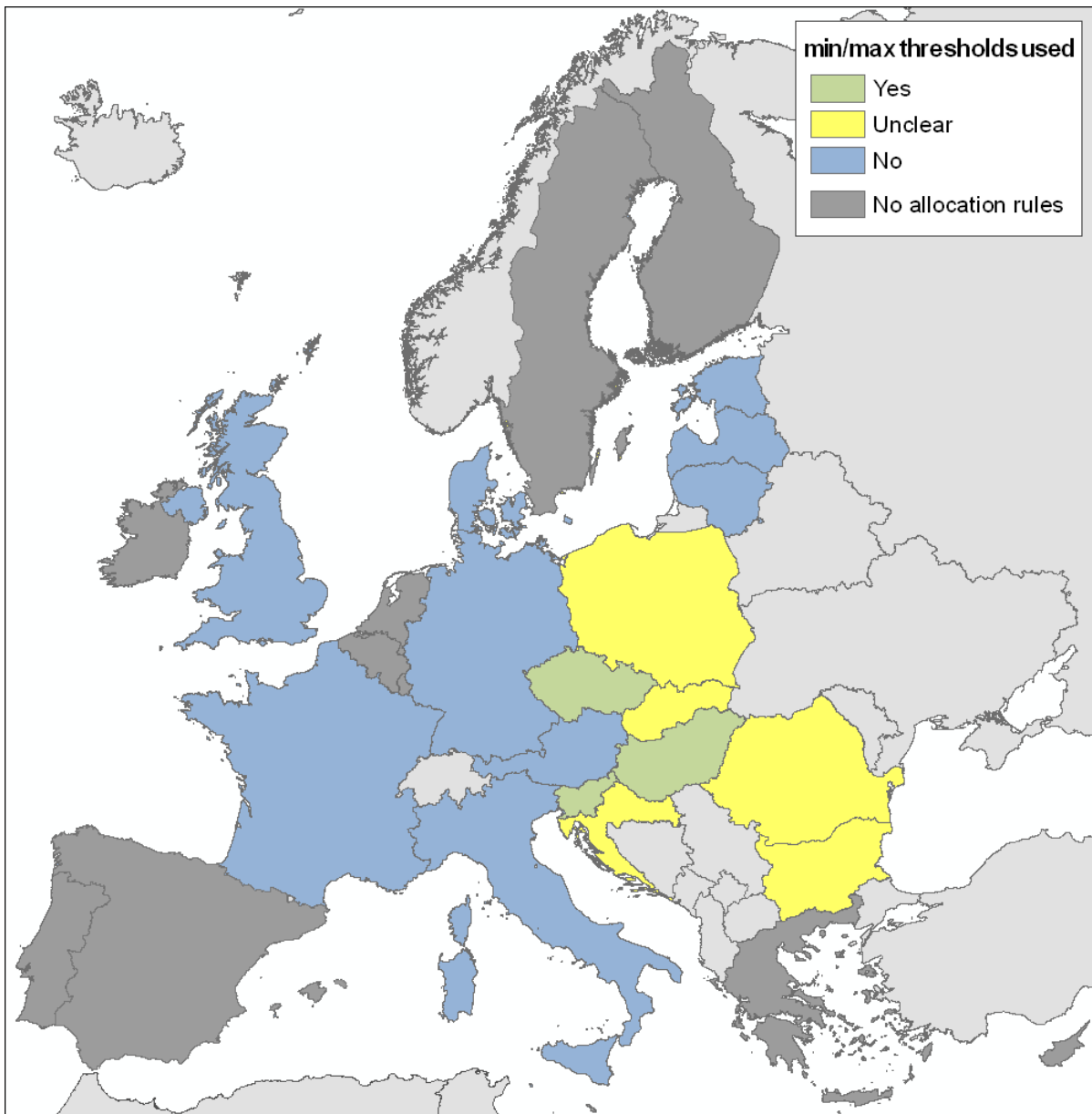
¹² For example, various studies and analyses have shown that in Slovenia the temperature of apartments positioned in the central part of multiple-apartment buildings does not drop below 14-17°C when the radiators are turned off, even in the coldest months (reference: Ministry of Infrastructure of Slovenia).

transfers at the expense of their neighbours will nevertheless pay a minimum contribution, the level of which was set at a level intended to reflect the cost for the heat that they receive passively from their neighbours. This approach limits the incentive to rely exclusively on passive heat transfers. On the other hand, it will not be possible for an individual apartment's costs to exceed the highest possible consumption. This way all occupants regardless of their actual energy saving behaviour can be seen as paying for the minimum consumption level necessary to keep the building at an adequate temperature, and the consumption-dependent charges for each occupant in turn reflect the additional heating required to reach the comfort levels they choose [2]. In Table 6, the minimum and maximum limits to the share of cost allocated to an individual unit in different Member States are presented.

How the value of the minimum and maximum consumption limits is set is not clear for all the Member States. In the case of Slovenia, the maximum consumption threshold (i.e. 300% of the average consumption) have been set considering that, according to some studies¹³, in an average Slovenian building, a central heating system cannot transfer more than three times the amount of heat per unit of heated surface area. On the other hand, the minimum consumption level of 40% of the average reflects an estimate of the minimum temperature which prevents excessive of the structure of the building (i.e. 14°C). In the choice of maximum and minimum limit values, Member States could consider, beyond the climate and the building stock characteristic, also energy poverty issues where such exist.

¹³ References are not available

Figure 5. Use of minimum and/or maximum individual heat cost limits in Member States



2.4 Building common area heat cost allocation rules

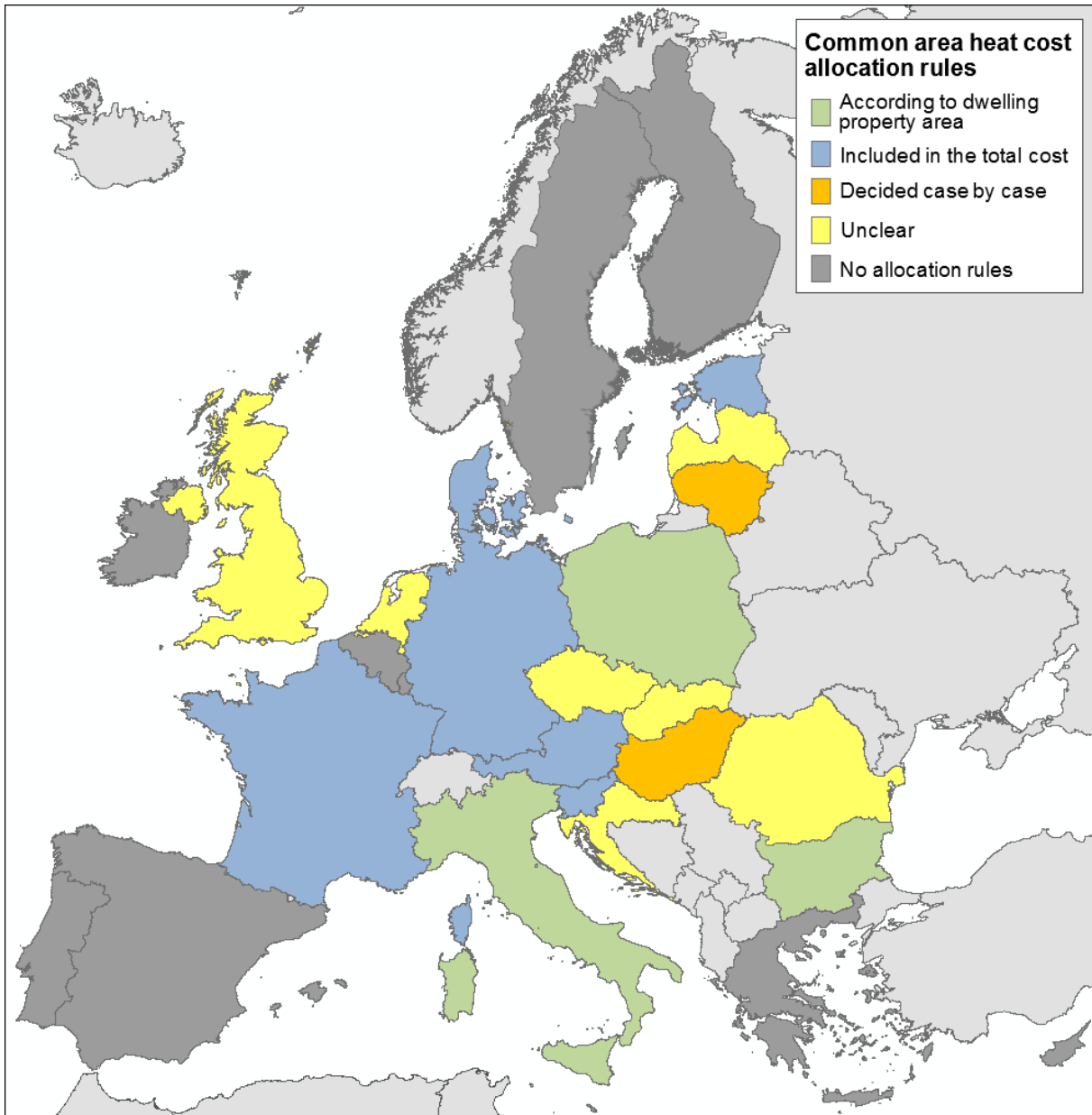
Article 9 (3) of the EED contains a specific reference to the cost of the heat used "for heating the building common areas (where staircases and corridor are equipped with radiators)". These costs are usually not directly controlled by individual user behaviours, and are typically included in Member States' allocation rules among the fixed costs. In Table 7 an overview of how these costs are treated in Member States' allocation rules is presented.

Table 7. Building common area cost allocation rules in Member States

Member State	Common area heat cost allocation rules
AT	Included in the total cost and then divided as all the other heat consumptions (e.g. 30% by dwelling property area / 70% by consumption)
BG	Allocated according to dwelling property area (m ²)
CZ	Unclear
DE	Included in the total cost and then divided as all the other heat consumption (e.g. 30% by dwelling property area / 70% by consumption)
DK	Included in the total cost and then divided as all the other heat consumptions
EE	Precise method for allocation is not specified in the legislation. Typically included in the total cost and then divided as all the other heat consumptions
ES	Unclear
FR	Included in the "fuel or energy expenses" and then divided in common (30%) and individual expenses (70%)
HR	Unclear
HU	Decided by the building owner assembly case by case
IT	Allocated according to dwelling property area (m ²)
LT	Decided by the building owner assembly case by case
LV	Unclear
NL	Unclear
MT	Unclear
PL	Cost distributed according to the area of common parts in proportion to the dwelling property area of occupied units
RO	Unclear
SI	Included in the total cost and then divided as all the other heat consumptions
SK	Unclear
UK	Unclear

In some Member States (e.g. AT, DE, FR, DE, SI) consumption in building commonly used spaces does not have to be recorded separately, but it is included in the total cost for heating and then allocated to tenants according to the existing allocation rules (e.g. in Germany, 30% by living space and 70% by consumption). In others (e.g. BG, IT and PL), these consumptions have to be metered and allocated according to individual dwelling property area (m²) (see Figure 6)

Figure 6. Building common area cost allocation rules in Member States



2.5 Introduction of penalties/incentives to discourage tampering

In order to enforce their application and prevent illegal behaviour (e.g. not allowing meter readings or meter tampering), well designed individual heat cost allocation rules also include appropriate and effective penalties or incentives. These for example can take the form of “dissuasive” default values.

In the analysed thermal cost allocation rules, this aspect has been addressed by Member States in different ways.

In Slovenia, dwellings for which consumption could not be measured for non-technical reasons - because either necessary access was not granted or a metering device had been tampered with - are charged 300% of the average consumption.

In Czech Republic, a similar approach is used: a tenant, who either damages or does not allow installation or reading of, or damaging metering devices, is charged three times the building average consumption costs (in m²).

3 Overview of thermal energy cost allocation rules in EU

In this section an overview of the status of implementation of thermal energy cost allocation rules in Member States is presented, together with references to the relevant national regulations.

3.1 Austria

The Austrian regulation "Heizkostenabrechnungsgesetz"¹⁴ describes the rules on how the heating and hot water costs are distributed in multi-apartment buildings with a common heat supply system.

A minimum of 55% and a maximum of 75% of the total energy costs shall be allocated according to individual meters; the remainder (25-45%) by heated living space. The exact shares may be agreed by the energy supplying company (e.g. building manager/owner responsible for the building's central heating system) and the heat consumer in a written contract. If an agreement cannot be found, the energy cost is divided by 65% according to metered consumption and 35% by living area. The non-consumption dependent energy costs and other operating costs (e.g. maintenance cost, ancillary equipment energy cost, metering service cost etc) shall be divided according to the living area. The same rules apply for the costs for the preparation of domestic hot water¹⁵.

The use of correction factors, taking into account the possible heat transfer between neighbouring flats and/or the disadvantageous location of some dwellings is not allowed.

Consumption in commonly used rooms (e.g. storage room for bicycles, laundry, hobby room or sauna¹⁶) does not have to be recorded separately, but is covered by allocation of total consumption according to individual share and share of living space.

Relevant regulation

- Heizkostenabrechnungsgesetz (HeizKG4).

3.2 Belgium

The Belgium federal government is responsible for defining rules for consumption based billing, allocation rules and billing information. Currently there is no regulation on federal level [2]. The Regions are competent for energy efficiency.

In a Flemish Government decree¹⁷ it is stated that "The Flemish Government can set further rules on the transparent and accurate calculation of the individual consumption and of the distribution of the costs of the thermal or hot water consumption for: hot water for domestic use; heat from the building installation for heating the common areas; for heating apartments". No further information is available.

¹⁴ Federal law on heating allocation rules (6/2/2017). An official translation would be useful to better analyse all the provisions in details

<https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10007277>

¹⁵ If heat is provided by a common heat supply system both for space heating and domestic hot water (DHW) without measuring the two separate fractions, their costs are divided as follows: space heating cost at least 60% and not more than 80%, domestic water preparation 20-40% (if no agreement is found between the heat supplier and the consumer, the costs are divided as follows: space heating 70%, DHW 40-20%.

¹⁶ The measured heating quantity for such rooms is divided either to all or to those owner-occupants, which have an access authorisation to the sauna.

¹⁷ Decree of 14 March 2014 amending the Energy Decree of 8 May 2009;

3.3 Bulgaria

In Bulgaria heat cost allocation rules for space heating and hot domestic water are defined in the Energy Act (EA)¹⁸ and in a related Ordinance of the Minister of Energy and Energy Resources¹⁹ [2].

Since the year 2000 in Bulgaria heated volume lump sum based tariff are not applied and the heat and hot water cost expenses are allocated according to the consumption metered by hot water meters and estimated by heat cost allocators (more than 90% of apartment buildings in Bulgaria have a "vertical columns heating distribution system")²⁰.

The heat cost allocation among the customers in residential flat buildings is done by the heat transmission company, the heat provider, or is assigned to a person registered in a public register with the Ministry of Energy. This person offers to the customers to sign a written contract describing the method of energy cost distribution, that comply with the procedure established by the "Ordinance 16-334 for heat delivery"²⁰.

As a general principle, the heat for heating a residential flat building is divided into the heat dissipated by the building heating system, heat for heating of common parts, and heat for heating of properties.

The cost of the heating is split in a fix and variable part. The fix one is calculated based on a formula (usually 25-40%) and is distributed among all customers in proportion to the heated volume of individual properties, and the difference between the cost for heating in the whole building and the calculated fix part is allocated mainly according to the readings of individual heat cost allocators.

The cost for the preparation of domestic hot water is based on the reading of main water meters. When a water meter is not installed, the costs for hot water are calculated based on a previous summer period and is a part of the energy costs for the building. Each individual property should have an individual hot water meter, and the allocation of the hot water is made using the readings of the individual water meters in the properties. When individual hot water meters are not installed consumers are charged with a "140 litres hot water flat rate" per day per person fee (about 4.5% of the apartments in Bulgaria do not have individual meters for DHW).

The use of correction factors is allowed, but they are rarely applied.

Relevant regulation:

- Energy Act (EA) - Закон за енергетиката (MNE(2015)53710) - promulgated in SG No 107/2003, last amended in SG No 48/2015 – BG:
<http://www.me.government.bg/bg/library/zakon-za-energetikata-256-c25-m258-1.html> EN: <http://www.me.government.bg/en/library/energy-act-256-c25-m258-1.html>;
- Ordinance 16-334 for heat delivery
<http://www.me.government.bg/bg/library/naredba-16-334-ot-6-april-2007-g-za-toplosnabdyavaneto-404-c78-m260-1.html>.

¹⁸ Energy Act (EA), Last Amendment - SG No. 56/24.07.2015, available in English
<http://www.me.government.bg/en/library/energy-act-256-c25-m258-1.html>

¹⁹ Ordinance 16-334 for heat delivery (text available in Bulgarian only. Official translation is needed to understand the method).

²⁰ Presentation of Dimitar Kuyumdjiev (Bulgarian Ministry of Economics and Energy) at the MBIC workshop in Warsaw on 14/11/2016 <http://mbic.eu/fileadmin/mbic/rce-warsaw/13-kuyumdjiev.pdf>

3.4 Croatia

In Croatia the installation of heat meters or heat cost allocators is required when there are two or more units in a central heated building.

A specific Ordinance²¹ on the Method of Distribution and Calculation of the Cost of Delivered Heat (OMD) prescribes how the heat costs had to be distributed among owners of "autonomous usable units" and provides several basic models for the allocation the costs, differentiated by the type of meter used and the installed heating systems.

Correction factors to consider unfavourable position of naturally colder flats are not used.

Cost for hot water for domestic needs can be calculated in different ways: if an hot water meter for apartment is installed, hot water cost is distributed as per measured consumption; if not, costs are distributed according to the number of occupants of every apartment in relation to the total number of tenants in the building. Moreover, in the event that there is no specific heat energy meter in the thermal substation for the measurement of the delivered heat energy for the preparation of DHW, the heat delivered in the heating season for the space heating of the premises and the preparation of DHW shall be measured together, and then the heat energy supplied for the preparation of hot water can be determined using one of the formula provided in the OMD.

Common area heat consumption had to be measured with energy meter, but how then they were divided among tenants is unclear (most likely according to dwelling property area).

Relevant regulation

- EEA - Energy Efficiency Act (Zakon o energetskej učinkovitosti) ("O.G.", No. 127/14) (MNE(2014)56090); adopted on 17 October 2014, entered into force on 6 November 2014; <http://www.zakon.hr/z/747/Zakon-o-energetskej-u%C4%8Dinkovitosti>;
- OMD - Ordinance on the Method of Distribution and Calculation of the Cost of Delivered Heat (Pravilnik o načinu raspodjele i obračunu troškova za isporučenu toplinsku energiju) ("O.G.", No. 99/14; 27/15; 124/15) (MNE(2014)55428), http://narodne-novine.nn.hr/clanci/sluzbeni/2014_08_99_1956.html; issued on 1 October 2014, entered into force on 1 September 2014;
- HMA - Heat Market Act (Zakon o tržištu toplinske energije) ("O.G.", No. 80/13; 14/14) (MNE(2013)56093), <http://www.zakon.hr/cms.htm?id=679>; adopted on 21 June 2013, entered into force on 8 July 2013.

3.5 Cyprus

According to the information available, in Cyprus no rules for heat cost allocation exist.

3.6 Czech Republic

In the Czech Republic heat cost allocation rules exist and are described in the Law Nr. 67/2013 Sb. and in the related Implementing Regulation Nr. 269/2015 Sb²².

²¹ Pravilnik o načinu raspodjele i obračunu troškova za isporučenu toplinsku energiju) ("O.G.", No. 99/14; 27/15; 124/15) (MNE(2014)55428), http://narodne-novine.nn.hr/clanci/sluzbeni/2014_08_99_1956.html; issued on 1 October 2014, entered into force on 1 September 2014 Old version OJ num. 139/08, 18/09, 136/11 i 145/11.

²² Decree on the distribution of heating costs and the preparation of domestic hot water <https://www.zakonyprolidi.cz/cs/2015-269>. An official translation of this key regulation is needed to better understand the details of the allocation rules.

According to these rules, a minimum of 30% and a maximum of 50% of the total space heating costs shall be considered as fixed costs and have to be distributed according to living area (m²); the remainder (50-70%) are allocated according to individual meters (usually, heat cost allocators)²³. Whereas for hot domestic water the share of fixed and variable costs is set to 30% and 70% respectively.

In the Czech Republic, along with other Eastern European countries (e.g. Hungary and Slovenia), minimum and maximum limits to the cost share allocable to a single unit are introduced: the costs of none of the tenants can be lower than -20% and higher than +100% (i.e. the double) of the building's average heating costs (calculated per m²). Moreover, the use of correction factor, to compensate the unfavourable position of dwellings, is required.

Penalties are also introduced; a tenant who does not allow installation or reading of devices or who damages metering devices, must pay the triple of the average consumption costs (per m²).

The rules on the allocation of heating cost of building common areas are unclear.

Relevant regulation

- Law Nr. 103/2015 Sb. (amendment of Nr. 406/2000 Sb.);
- Law Nr. 318/2012 Sb. (amendment of Nr. 406/2000 Sb.) and Implementing regulation Nr. 237/2014 Sb;
- Law Nr. 104/2015 Sb. (amendment of Nr. 67/2013 Sb.) and Implementing Regulation Nr. 269/2015 Sb.

3.7 Denmark

In Denmark allocation rules are defined in the Ministerial Order No 563 of 2 June 2014²⁴ and in the related implementation guidelines²⁵.

A minimum of 40% of the total heating costs (including heating of hot water) must be allocated according to individual meters. If only the space heating is considered, a minimum of 60% must be allocated according to individual heat meters or heat cost allocators. The specific allocation of costs is handled by the energy supplier (or building owner). The consumption independent part include the fixed costs such as, for network access (e.g. for district heating).

Moreover in Denmark are used correction factors to compensate for heat transfers between dwellings as well as for to adjust the heating costs of apartments located in the outermost parts of the building. This is because these apartments require more energy for heating, and the purpose of the correction factors is to divide heating costs fairly. Radiator sizes, consumption in previous years and values from comparable buildings can be used to determine correction factors, if the original heat loss calculation is not available [2].

Correction factors are applied either on the share of the consumption or the share not directly dependent on the individual consumption. Correction factors must be updated whenever the building is significantly changed and can only be disregarded if heat loss has already been taken into consideration when determining the dwelling rent or the

²³ Information gathered from the presentation of Ing. Tomáš Koňářík (Techem), EED implementation in The Czech Republic & basic principles of heating costs allocation, given at the MBIC Workshop on 14.11.2016 in Warsaw.

²⁴ <https://www.retsinformation.dk/Forms/R0710.aspx?id=163405>

²⁵ <https://www.retsinformation.dk/Forms/R0710.aspx?id=174884>. Guidelines for individual measurement of electricity, gas, water, heating and cooling. An official translation of this key document is necessary to understand in details the regulation framework.

evaluation would be too expensive (or unnecessary). Examples of correction factors for a multi-apartment building are provided in Figure 7.

The Danish guidelines for individual measurement of electricity, gas, water, heating and cooling¹⁵ include also a specific section on the allocation of cooling cost in multi user buildings, distinguishing between existing and new buildings. In case of district cooling or central water based cooling system, a specific cold meter for the refrigeration system have to be installed (air cooling systems are excluded). In existing buildings, individual cooling energy meters has to be installed only if it is technical feasible and cost effective.

Figure 7. Example of correction factor used in Denmark

Top floor:	50 %	40 %	40 %	40 %	40 %	40 %	40 %	40 %	50 %	Top floor:	50%	40 %	40 %	40 %	40 %	40 %	40 %	40 %	50 %
Middle floor(s):	30 %	0	0	0	0	0	0	0	30 %	Middle floors:	30 %	0	0	0	0	0	0	0	30 %
Ground floor:	(30)	0	0	0	0	0	0	0	(30)	Ground floor:	(30)	0	0	0	0	0	0	0	(30)
	40 %	15 %	15 %	15 %	0	0	15 %	15 %	40 %		30 %	0	0	0	50 %	50 %	0	0	30 %
					(heated)						40 %	15 %	15 %	15 %	(gateway)	15 %	15 %	40 %	

Relevant regulation

- Ministerial Order No 563 of 2 June 2014, MNE(2014)53300 <https://www.retsinformation.dk/Forms/R0710.aspx?id=163405>;
- Guidelines for individual measurement of electricity, gas, water, heating and cooling: <https://www.retsinformation.dk/Forms/R0710.aspx?id=174884>.

3.8 Estonia

Allocation rules in Estonia are based on act regulating the co-ownership of land and buildings. Dominant share of multi-family buildings will be subject to Apartment Ownership and Apartment Associations Act. This act, repealing the existing Apartment Ownership Act and Apartment Associations Act, does not update cost sharing principles in the existing acts. By default, all the apartment owners are paying according to the size of their share in the common ownership²⁶. However, they may agree other cost distribution principles in the articles of association of apartment association (statute of the apartment association). The articles of association of apartment association are endorsed by an apartment owners assembly.

If a measurement or cost allocation system is installed in a building, cost distribution shares and correction factors (e.g. fixed and variable costs) are decided by the apartment owners assembly and the costs are then allocated on the basis of flat size and meter readings. Although there are not any guidelines published by public authorities, many apartment associations are relying on recommendations proposed by companies offering measurement and/or cost allocations systems and services.

Cost distribution rules for domestic hot water are not specified in the legislation. Typically, a part of costs is based on DHW meter readings. When the space heating system is turned on in a building, costs are calculated based on meter readings. Otherwise, costs arising from DHW system heat losses are added on top of that. These costs are distributed in proportion to the area of the properties.

Relevant regulation

- Apartment Ownership Act (15.11.2000, entry into force 01.07.2001, will be repealed 01.01.2018);

²⁶ See section (§) 40 paragraph 1 of the Ownership and Apartment Associations Act

- Apartment Associations Act (27.06.1995, entry into force 03.08.1995, will be repealed 01.01.2018);
- Apartment Ownership and Apartment Associations Act (19.02.2014, entry into force 01.01.2018), also available in English²⁷;
- District Heating Act (11.02.2003, entry into force 01.07.2014);
- District Heating Act MNE (2014) 53898, also available in English²⁸.

3.9 Finland

According to the information available, no heat cost allocation rules based on consumption are defined in Finland and the costs are allocated on the basis of flat floor area only.

In particular, the Finnish Energy Efficiency Act²⁹ does not require the installation of individual consumption meters or heat cost allocators in multi-apartment buildings because individual heat meters as well as heat cost allocators have been assessed as not cost-efficient in the Finnish context.

After the adoption of the EED, the Finnish Ministry of Employment and Economy asked the Technical Research Centre of Finland (VTT) to investigate the cost-efficiency of individual heat meters and heat cost allocators in multi-apartment buildings. The conclusion of the study was that individual heat meters or even heat allocators would not be a cost-effective in Finland³⁰.

Information on cost allocation on domestic hot water is not available.

Relevant regulation

- Energy Efficiency Act (1429/2014), as issued 30.12.2014 (MNE(2015)50503), Energiatohokkuuslaki ['Energy Efficiency Act'], <https://www.finlex.fi/fi/laki/ajantasa/2014/20141429>;
- Act on Monitoring the Electricity and Natural Gas Markets (590/2013), as last amended on 30.12.2014 (MNE(2014)53441), Laki sähkö- ja maakaasumarkkinoiden valvonnasta ['Act on Monitoring the Electricity and Natural Gas Markets'], <http://www.finlex.fi/fi/laki/alkup/2013/20130590>.

3.10 France

In France, according to the Decree n° 2016-710³¹, the expenses related to collective heating are divided into "fuel or energy expenses" and "other heating expenses" (i.e. operation and maintenance costs, electric consumption linked to the functioning of the heating system such as pumps, fans, burners, control devices etc).

Fuel or energy expenses (including the energy needed to heat building common area) shall be divided between the premises served, distinguishing between "common" and "individual" expenses. The "common expenses" are calculated as the 30%³² of the total

²⁷ <https://www.riigiteataja.ee/en/eli/518052017002/consolide>

²⁸ <https://www.riigiteataja.ee/en/eli/501092014003/consolide>

²⁹ Energy Efficiency Act (1429/2014), as issued 30.12.2014 (MNE(2015)50503), *Energiatohokkuuslaki* ['Energy Efficiency Act'], <https://www.finlex.fi/fi/laki/ajantasa/2014/20141429>

³⁰ Selvitys huoneistokohtaisten lämpö määrämittareiden ja lämmityskustannusten jakolaitteiden käytön edellytyksistä Suomessa, in Finnish, www.tem.fi/files/38260/EED_lammonkulutuksen_mittaus_19_11_2013_netiversio.pdf

³¹ Décret n° 2016-710 du 30 mai 2016 relatif à la détermination individuelle de la quantité de chaleur consommée et à la répartition des frais de chauffage dans les immeubles collectifs

<https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000032611296&categorieLien=id>

³² In case of buildings where individual heat meters are already installed, the coefficient chosen between 0% and 50% at the time of installation of these appliances shall be retained. However, the general assembly of co-owner may replace the initial coefficient by the coefficient 30%.

fuel or energy expenses. These "common expenses" are then allocated according to rules defined in the co-owner regulation. The other 70% (individual expenses) are split between the premises, according to actual consumption measured by individual heat meters or by individual heat cost allocators. Correction factors to consider unfavourable position of naturally colder flats (e.g. because located under the roof, over the parking space, at the corner of the building, oriented north etc) can be introduced and require the agreement of the general assembly of the co-owners.

The "Other heating expenses" shall be distributed according to the conditions set in the co-owner regulation (e.g. by premise living area).

As regards DHW, individual metering is mandatory since 1974. The DHW preparation expenses are split between the premises according to the measured consumption.

Relevant regulation for heating:

- Décret n° 2016-710 du 30 mai 2016 relatif à la détermination individuelle de la quantité de chaleur consommée et à la répartition des frais de chauffage dans les immeubles collectifs;
- Arrêté du 30 mai 2016 relatif à la répartition des frais de chauffage dans les immeubles collectifs;
- Article L.241-9 et articles R.241-7 à R.241-13 du code de l'énergie.

Relevant regulations for hot water:

- Article L.241-9 et articles R.241-15 à R.241-20 du code de l'énergie.

3.11 Germany

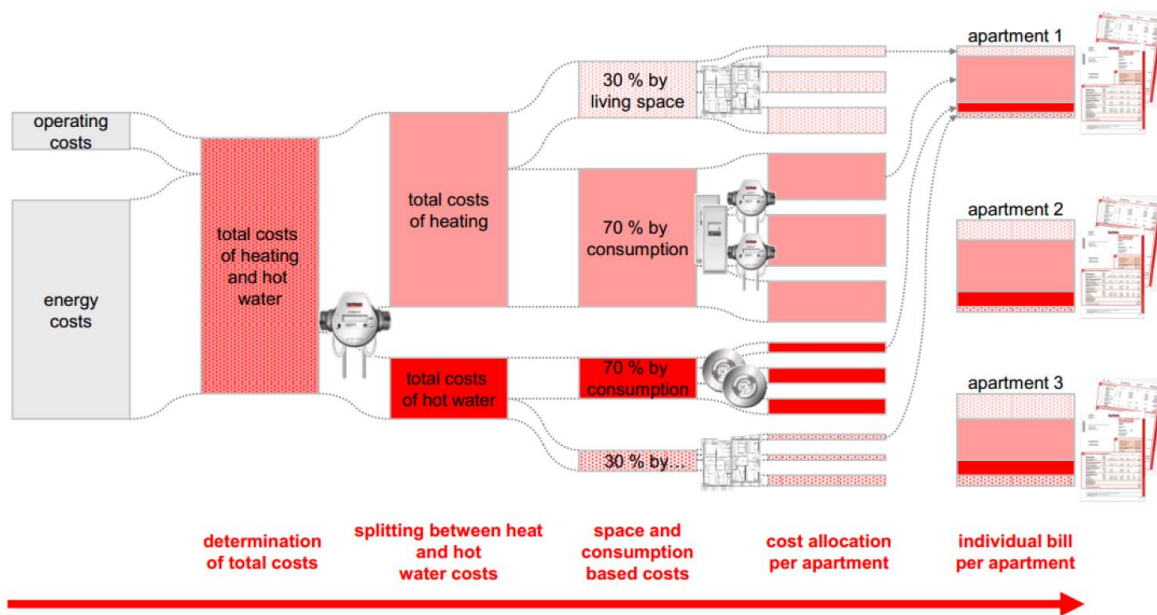
The German regulation "Heizkostenverordnung" (Regulation on the consumption-based billing of energy and hot water costs)³³ allows for some flexibility in the distribution of costs depending on dwelling size and level of consumption [2]. The building owner can decide in the rental contract with tenants the share of the "total costs of heating and hot water" to be allocated by living space, provided this is set in the range 30 to 50%, corresponding to distribution of 50-70% of these total costs by consumption. In some cases, e.g. the tenants influence on consumption of heating energy is high (especially in older buildings with bad thermal insulation) and the heating is based on oil or gas and the heat distribution system is well insulated, it is required that 70% is consumption-based.

In Figure 8 the typical heat cost and hot water allocation scheme in a German multi-apartment building is described (for the example 30% / 70%). Energy costs and the operating costs of the heating system are combined in the "total costs of heating and hot water". A meter near the boiler measures the total consumption of energy used to heat water and is used to determine the respective shares of hot water and space heating in the overall costs. In the next step, 30% of each of these sums is distributed according to the tenant's share of the total living space. Hence, a larger flat will have to cover a greater part of the heating cost as it benefits more from heat being radiated through walls etc. The remaining 70% of the costs are distributed according to the tenant's individual metered share of the consumption. Applying correction factors, to compensate the unfavourable position of dwellings, is not allowed³⁴.

³³ Verordnung über die verbrauchsabhängige Abrechnung der Heiz- und Warmwasserkosten (Verordnung über Heizkostenabrechnung - HeizkostenV) <https://www.gesetze-im-internet.de/heizkostenv/>

³⁴ A method for the consideration of unaccounted-for heat loss through pipes is used (VDI 2077)

Figure 8. German heat cost allocation rules in multi-apartment buildings



Consumption in commonly used rooms does not have to be recorded separately³⁵, but is covered by allocation of total consumption according to individual share and share of living space. The same principle applies to water consumption: the total consumption is recorded as the total amount of water consumed in m³.

Relevant Regulation

Federal laws:

- Bürgerliches Gesetzbuch (BGB) §§ 556ff;
- Gesetz zur Einsparung von Energie in Gebäuden (EnEG) § 3a³⁶ (Low on Energy Efficiency in Building);
- Verordnung über Heizkostenabrechnung (Calculation of Heat Costs Regulation, HeizkostenV) in der Fassung der Bekanntmachung vom 5. Oktober 2009 (BGBl. I S. 3250) (MNE 2014 53416), <https://www.gesetze-im-internet.de/heizkostenv/>

3.12 Greece

According to the information available heat cost allocation rules are foreseen in Greece, but still have not been defined [2].

3.13 Hungary³⁷

In Hungary heat cost allocation rules in multi-apartment buildings are defined, but only for district heating, by a Government Decree³⁸. There is no legal implementation of similar allocation rules for other means of central heating [2].

³⁵ Unless a room is the reason for significantly higher consumption such as a swimming pool, sauna etc.

³⁶ <http://www.gesetze-im-internet.de/eneg/>

³⁷ This section is mainly based on the information provided by Tímea Sütő, Ministry of National Development Energy Regulation Department in its presentation on Metering of district heating consumption in multi-apartment buildings on the, Regional Workshop on the Implementation of the Energy Efficiency Directive, 14th November 2016, Warsaw

³⁸ Government Decree No. 157/2005. (VIII. 15.) of the Government Implementing Act XVIII of 2005 on District Heat Supply (https://net.jogtar.hu/jr/gen/hjegy_doc.cgi?docid=a0500157.kor)

The cost allocation is directly managed by the condominium owners assembly; when heat cost allocators are installed, at least 30% but maximum 50%³⁹ of the consumed heat quantity shall be divided between the units on the basis of the volume of the unit, the remaining quantity shall be divided based on the information provided by heat cost allocators, taking also into account room orientation correction factors (see Table 8). An example of heat allocation calculation is provided in Figure 9.

If the condominium decides to use heat cost allocators, but some owners do not allow mounting them in their flat or refusing readings, they are billed by factor 2.5 of the building average consumption.

Moreover, Hungary introduced limits to the share of costs allocated to individual units: the maximum share of consumption is limited to 2.5 times of the building's average consumption.

A different cost allocation scheme can be applied if it is accepted by the owners' assembly and confirmed by a detailed energetic calculation.

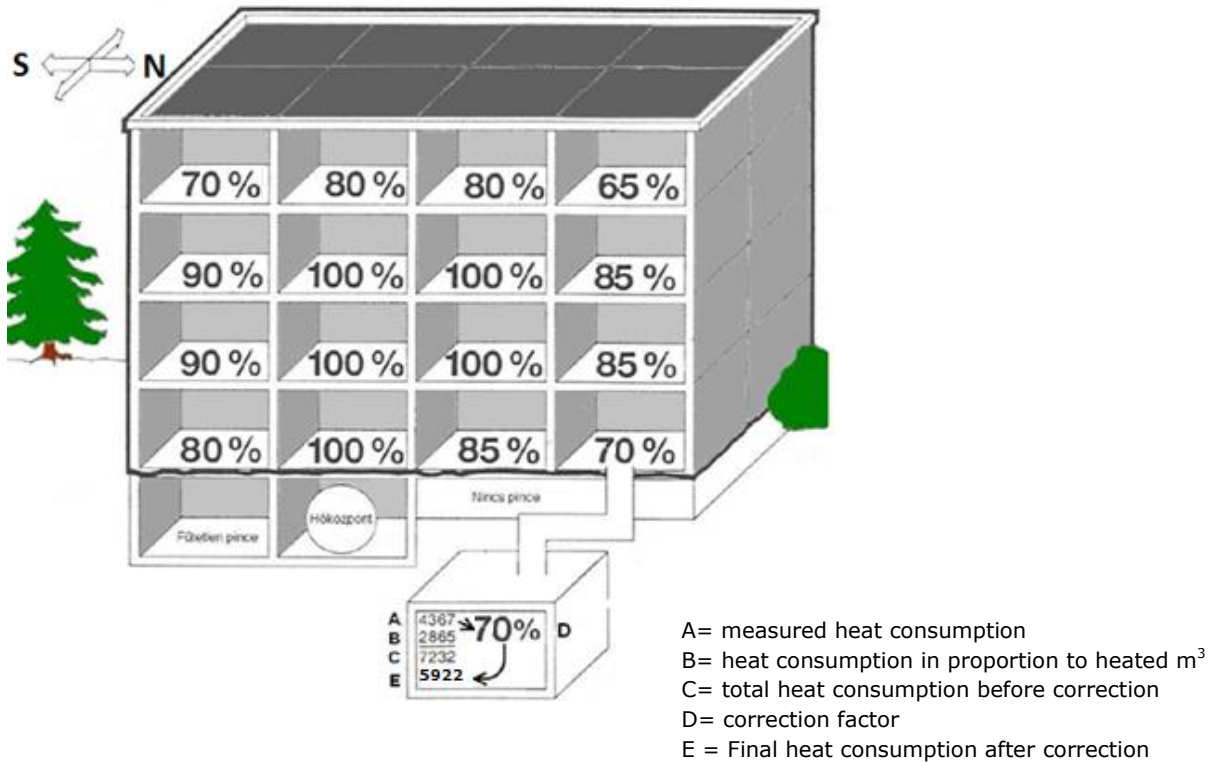
Installing the allocators in building common areas is not required; the Owner assembly can decide how to distribute the heat cost for these areas.

Table 8. Room position/orientation correction factors used in Hungary

Room position in the building	Correction factors
Ground floor no premises underneath	-15%
Ground floor with unheated premises underneath	-10%
Unheated passageway or premises beyond gateway	-15%
Premises beyond unheated ground floor	-5%
Premises next to unheated stairway or corridor	-10%
Premises directly beneath the flat roof	-20%
Premises beneath non built-in attic	-15%
Beneath built-in unheated attic	-10%
Corner room with at least 2 outward surfaces	-10%
Northern side correction	-5%

³⁹ The exact proportion is decided by the condominium owners assembly

Figure 9. Example of the use of correction factors in Hungary



3.14 Ireland

According to the information available heat cost allocation rules are not defined in Ireland.

3.15 Italy

In Italy, according to the Legislative Decree n. 102/2014⁴⁰, where multi-apartment buildings are supplied from a common heating or cooling systems, the allocation of the cost of thermal or hot water consumption to each apartment shall be made on the basis of the National Standard UNI 10200⁴¹.

According to this norm, space heating and hot water expenditures are divided on the basis of:

- "Voluntary consumption" (or "variable quota"), namely those due to voluntary actions of the user via temperature control systems (e.g. thermostatic valves or room thermostats) and,
- "non-voluntary consumption" (or "fixed quota"), independent to user actions (e.g. heat losses of the distribution network within the building).

⁴⁰ <http://www.normattiva.it/atto/caricaDettaglioAtto?atto.dataPubblicazioneGazzetta=2016-07-25&atto.codiceRedazionale=16G00153¤tPage=1>

⁴¹ <http://biblus.acca.it/focus/ripartizione-spese-riscaldamento-uni-10200/>

The cost of the "voluntary consumption" is allocated according to the consumption measured in each apartment (by heat meters, heat cost allocators or other), the "non-voluntary consumption" is distributed according to dwelling "useful thermal energy need"⁴² or "millesimi di fabbisogno di energia termica utile" (calculated according to the Standard UNI-TS 11300). Thus the variable and the fixed quota shares (e.g. 70-30%) are not defined in the norm, but can vary in different buildings according to the specific building heating system heat losses⁴³ (see Figure 10).

The heating system ordinary maintenance⁴⁴, its operating expenses (e.g. electricity consumption of pumps, fans, boiler control system etc), and the cost for the heat cost allocation service, are allocated according to the "dwellings useful thermal energy need". Whereas "extraordinary maintenance" costs and the cost for heating building common area (e.g. building hall, corridors and staircases if equipped with radiators) are allocated according to dwelling property area ("millesimi di proprietà").

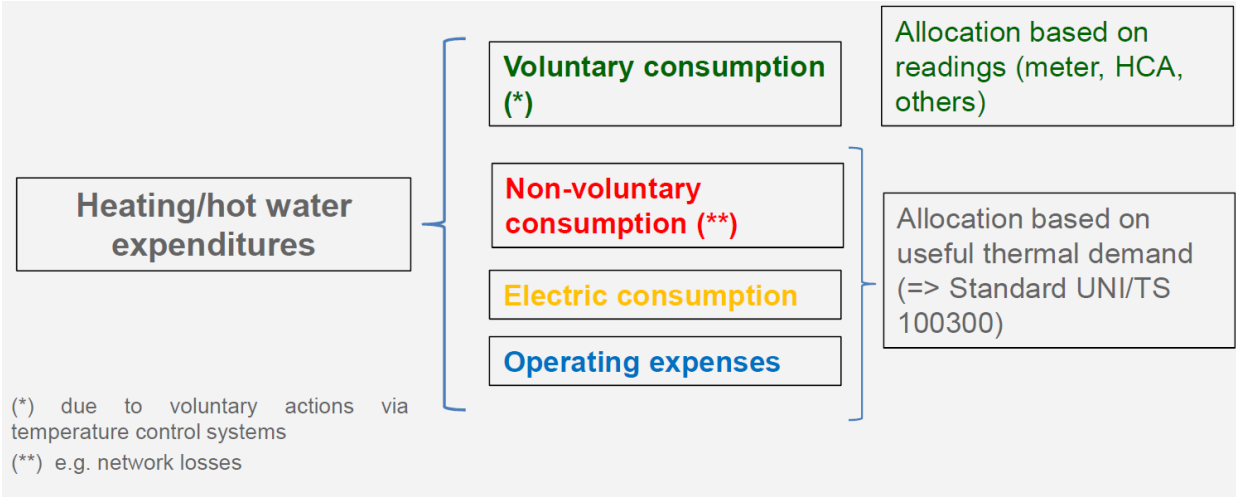
The use of correction factors, based on the position of the dwelling in the building (e.g. ground floor or north/south orientation) is not allowed.

The updated Legislative Decree 141/2016 (released in July 2016), under certain circumstances (e.g. if the "useful thermal energy need" of at least one dwelling in the building is more than 50% higher than another dwelling), now permits to ignore the standard UNI 10200, but prescribes that the maximum share of the fixed costs has to be 30%.

The allocation of the costs incurred in the first year following the installation of the metering devices (meters, HCAs or others) may be made only according to dwelling property area.

The individual Regions (20) ensure that "multi-apartment buildings" comply with these provisions and impose financial penalties in case of infringement.

Figure 10. The Italian heat cost allocation scheme



⁴² This value (i.e. "millesimi di fabbisogno di energia termica utile" or "pro rata heating in thousandths for the property") is the amount of thermal energy (in kWh) needed to heat an apartment according to legislation, i.e. up to 20°C (+2°C max intolerance), to simplify, it is somehow related to the dwelling area, its position in the building and its heat losses/gains.

⁴³ In the case of non-permanently occupied houses, such as "vacation houses", it could happen that in winter, non-voluntary consumptions exceed 80% of total heat consumption. The norm is under revision to correct this distortion.

Relevant regulation

- Consolidated version of the Decree 102/2014 with all changes introduced with the Decree 141/2016 http://www.bosettiegatti.eu/info/norme/statali/2014_0102.htm
- Decreto Legislativo 4 luglio 2014, n. 102 'Attuazione della direttiva 2012/27/UE sull'efficienza energetica, che modifica le direttive 2009/125/CE e 2010/30/UE e abroga le direttive 2004/8/CE e 2006/32/CE' (Legislative Decree 4 July 2014, No 102, 'Transposition of Directive 2012/27/EU on energy efficiency,)
<http://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legislativo:2014-07-04;102!vig=http://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legislativo:2014-07-04;102!vig=%20>
- UNI 10200:2015 "Impianti termici centralizzati di climatizzazione invernale e produzione di acqua calda sanitaria - Criteri di ripartizione delle spese di climatizzazione invernale ed acqua calda sanitaria".

3.16 Latvia

In Latvia the heat cost allocation rules are described in the Cabinet of Ministers Regulations No. 524 (15/9/2015)⁴⁵. This law has eleven annexes, describing several different types of calculation methodologies, according to the presence in the buildings of heat meters and/or heat cost allocator⁴⁶. The apartment owners can decide and agree in their assembly which calculation rules to apply (e.g. heating costs allocated by flat m² or by metered consumption or a combination of both).

Correction factors, taking into account intrinsic different heat losses of flats, may also be used. These factors are calculated for each building by an independent expert on energy performance of buildings.

Relevant regulation

- Cabinet of Ministers Regulations No. 524 (15/9/2015), Procedures for identifying, measuring, and record each residential home owner paid part for the residential house maintenance necessary services (15 September 2015)

3.17 Lithuania

According to the rules of "Preparation and Application of the Methods of Distribution (Allocation) of the Heat Energy Quantity for Consumers"⁴⁷ the *National Commission for Energy Control and Prices* has presented ten methods for the allocation of the heat energy quantity consumed in a building⁴⁸. These methods can be used, according to the type of measurement device used, and the heating and hot water systems types installed. Apartment owners of the building and/or the building owners' association can decide which of these methods apply in their building. The decision must be approved by 50% plus one vote by apartment owners and then the agreed method shall be authorised/validated by the National Commission for Energy Control and Prices.

Correction factors to compensate the heating cost of dwellings in the outermost parts of the dwellings have to be used⁴⁹.

⁴⁵ "Procedures for identifying, measuring, and record each residential home owner paid part for the residential house maintenance necessary services" <https://likumi.lv/ta/id/276739-kartiba-kada-nosaka-aprekina-un-uzskaita-katra-dzivojamas-majas-ipasnieka-maksajamo-dalu-par-dzivojamas-majas-uzturesanai>

⁴⁶ For a detailed analysis of these allocation rules and calculation methodologies, a professional translation into English of this key document is needed.

⁴⁷<http://www.regula.lt/Puslapijai/naujienos/2016-metai/birzelis/2016-06-09/keiciasi-silumos-paskirstymo-metodai-ir-ju-rengimo-bei-taikymo-taisykles-.aspx>

⁴⁸<http://npilaitė.lt/wp-content/uploads/2014/07/%C5%A0ilumos-paskirstymo-metodai.pdf>.

⁴⁹ Correction factor values are listed in the Annex 3 of the Resolution on methods no. 3 for the distribution of heat in households: www.e-tar.lt/portal/lt/legalAct/654812a0323011e69cf5d89a5fdd27cc

Relevant regulation

- Preparation and Application of the Methods of Distribution (Allocation) of the Heat Energy Quantity for Consumers.

3.18 Luxemburg

According to the information available, no heat cost allocation rules are defined in Luxemburg.

3.19 Malta

According to Energy Efficiency and Cogeneration Regulations⁵⁰, in Malta allocation rules are foreseen but not fully defined [1].

Relevant regulation

- Energy Efficiency and Cogeneration Regulations, 2014 (LN 196 of 2014) (MNE (2014) 53824).

3.20 The Netherlands

In The Netherlands cost allocation is common in multi-apartment buildings in case there is no individual heat meter. This is required by the heat law (2013) which main aim is consumers' protection. The cost allocation is based on the heat used in the apartment. The price consists of a fixed and variable part. Both are related to the costs of a heating system with natural gas, which is the reference heating system in the Netherlands. There is no limit set for the share of variable and fixed costs. There is a maximum set for the fixed costs and a maximum for the prices per delivered GJ of heat⁵¹. If an apartment is not using any heat according to the cost allocation measurement, the inhabitant pays only the fixed cost.

Space heating and domestic hot water are normally delivered together. If they are measured separately the sum of the fixed prices for space heating and domestic hot water should not be more than the regulated maximum for the fixed price. The maximum price for the delivered heat in GJ applies for both space heating and domestic hot water.

The heating law will be updated in 2017. In the update the use of correction factors for existing buildings will be included.

Relevant regulation

- Act of 17 June 2013, containing rules regarding the delivery of heat to users (Heat generation Act)), (Wet van 17 juni 2013, houdende regels omtrent de levering van warmte aan verbruikers (Warmtewet), Stb. 2012, 682, (MNE(2014),53238), Heat Generation Act; <http://wetten.overheid.nl/BWBR0033729/2015-07-01> Warmtebesluit BWBR0033940 <http://wetten.ovebrheid.nl/BWBR0033940/2014-01-01>");
- Warmteregeling BWBR0033862 <http://wetten.overheid.nl/BWBR0033940/2014-01-01>;
- Proposed update of the heating law: <https://www.tweedekamer.nl/kamerstukken/detail?id=2017D14327> and an explanation of the changes: <https://www.tweedekamer.nl/kamerstukken/detail?id=2017D14328>

⁵⁰ <http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lp&itemid=26107&l=1>

⁵¹ It's a price cap, main aim of the regulation is consumer protection. The price cap (maximum price) is calculated on the base of a gas reference.

3.21 Poland

The recently approved Energy Efficiency Law⁵², implementing the EED provisions in Poland, sets only general principles for the allocation of heat costs in multi-apartment buildings giving to the owners and administrators some flexibility in choosing the heat cost allocation methods. According to the law, the chosen methods shall ensure "energy efficiency behaviours", maintenance of building proper operating conditions of indoor temperature and ventilation and set heat charges consistent with the energy consumed by each unit for space heating and for the preparation of domestic hot water. No fixed ranges (e.g. 30%/70%) for the distribution of the costs according to metered consumption and living space (m³) are set in the current legislation⁵³. As a result there are no common and unique rules for heat cost allocation in Poland.

According to the new energy law, if a tenant does not provide access to individual meters and/or tampers with them he is charged with the average heating cost of the building. This provision do not seems to be very effective to disincentive incorrect tenant behaviours.

The costs for heating the common parts of multi-apartment buildings are divided in proportion to the floor space of occupied units.

There is a strong debate among relevant stakeholders (e.g. Energy Allocation Association, academics and other experts) on which minimum share of fixed cost shall be used and how it should be determined (different analytical methods are under discussion)⁵⁴. The values under discussion are quite high (minimum 55-90%^{55,56}) in comparison with the one used in other countries.

Moreover, the Polish law introduced an original and interesting provision, not found in the other Member State allocation rules: if the amount of heat delivered to the multi apartment building, during 12 successive months, exceeds 0.40 GJ per m³ of the heated volume of the building as a whole (or 0.30 GJ with respect to m³ of prepared hot water), the owners or administrators of the building shall perform an energy audit to identify the causes of the excessive energy consumption and to indicate possible ways to reduce the heat consumption.

Relevant regulation

- Energy Efficiency Law (20/5/2016), amendments to the Energy Law;
- Ustawa z dnia 3 października 2008 r. o udostępnianiu informacji o środowisku i jego ochronie, udziale społeczeństwa w ochronie środowiska oraz o ocenie oddziaływania na środowisko (Dz. U. z 2013 r. poz. 1235, z późn. Zm);

⁵² The act adopted by the Parliament on 20 May 2016 comes into force in October 2016. <http://dziennikustaw.gov.pl/DU/2016/831>. Art. 45a of Energy Law contains only the obligation to install individual heat meters or water meters, according to their technical feasibility and cost-effectiveness, but it does not provide the obligation to install heat cost allocators in the existing multi-unit residential buildings in which is impossible to install heat meters (i.e. vertical heat distribution buildings, approximately 3.5 million apartments). In these buildings heat cost will be still allocated according to the apartment surface. Despite the absence of metering obligation, about 50% of a total of 6.5 million apartments in multi-unit buildings is nowadays billed according to individual consumption (mostly using heat cost allocators.).

⁵³ According to the information gathered at the MBIC workshop in Warsaw, there is a strong debate in Poland on how to revise the current heat cost allocation framework in order to improve its accuracy and fairness (e.g. introducing min/max share of consumption per units).

⁵⁴ See presentation of Paweł Michnikowski (Institute of Environmental Engineering, Lodz University of Technology) at the MBIC workshop in Warsaw on 14/11/2016. <http://mbic.eu/fileadmin/mbic/rce-warsaw/08-michnikowski.pdf>

⁵⁵ Various publications and speeches, the two scientists Kazimierz, Cezary Pieńkowsky have argued that that the allocation of heating costs in apartments equipped with allocators in multi-family buildings is possible only when fixed costs amount to 75%.

⁵⁶ A Legal Court Decision in Białystok stated that if a residential building has no thermostatic valves preventing the internal temperature from dropping below 16°C, the fixed fee must be at least 90%.

- Rozporządzenie Ministra Infrastruktury z dnia 12 kwietnia 2002r. w sprawie warunków technicznych, jakimi powinny odpowiadać budynki i ich usytuowanie (Dz. U. Nr 75 z dnia 15.06.2002 r., poz. 690) z późniejszymi zmianami;
- Ustawa z dnia 10 kwietnia 1997 r. - Prawo energetyczne (Dz. U z 2012 r. poz. 1059, z późn. zm. 11).

3.22 Portugal

According to the information available, no heat cost allocation rules are defined in Portugal.

3.23 Romania

According to the Energy efficiency Law no.121/2014, in Romania it is mandatory to install meters for heating/cooling and domestic hot water in each individual flats in multi-unit buildings supplied by centralized heating systems⁵⁷. The cost allocation rules for space heating and hot domestic water are defined in a technical norm (Ordinance 343/2010⁵⁸) that includes the calculation formula related to the cost allocated to each, determined as the sum of individual and common consumptions⁵⁹ and the correction factors (room based) to be used for taking into account the unequal geometrical exposure of building rooms.

In Romania at present there are several problems with the heating energy market and the current cost allocation framework (e.g. only a small fraction of flats is equipped with heat cost allocators/heat meters; thousands of families close all the radiators in order to reduce the bill and/or use "alternative illegal heating systems"; presence of mould and dampness in rooms etc) according to the Romanian Federation of Owners Associations, which is proposing to revise it as follows:⁶⁰

- In central heated buildings with at least three flats, in order to protect the building structure and the health of the occupants, an average indoor temperature of at least 18 degrees Celsius shall be guaranteed;
- In the buildings in which individual heat meters or heat cost allocators are installed, the heat cost shall be divided in fixed cost and variable cost;
- The fixed cost refers to the minimum heating energy needed to guarantee an average indoor temperature of 18 degrees Celsius and represents 60% of total cost. This cost shall be attributed to all co-owners connected to the building centralised heating system of the building, in relation to the volume of their properties (m³). The reminder (40%), variable costs, shall be allocated in base of the individual consumption registered by the meters or heat cost allocators.

It is unclear if the proposed new rules will be approved and when.

Relevant regulation

National legislation:

- Law 121 / 2014 on energy efficiency (transpose the provisions of Directive 2012/27/EU into national legislation) Legea nr.121 / 2014 privind eficienta energetica;

⁵⁷ In Romania (2016) there are 3 Million flats (97% privately owned): 1.2 Mil. connected to District Heating, 0.63 Mil. With individual central heating and 1.17 Mil. use "illegal heating source" (e.g. coal, firewood etc). Only 0.5 Mil flats have Heat Cost Allocators (out of 3 Mil.)

⁵⁸ https://www.primariapn.ro/fisiere/asociatii_proprietari/ord_343_2010_2011.pdf

⁵⁹ For a detailed description of the cost allocation method, a professional translation of the Ordinance 343/2010 is needed.

⁶⁰ Presentation of Mr Eadu Opaina (Federation of Owners' Association) at the MBIC workshop in Warsaw on 14/11/2016 <http://mbic.eu/fileadmin/mbic/rce-warsaw/07-opaina.pdf>

- Government Decision 933 / 2004 on metering of consumers connected to centralized public system of thermal energy supply HG nr.933/2004 privind contorizarea consumatorilor racordati la sistemele publice centralizate de alimentare cu energie termica;
- Law 325 / 2006 on the public service of thermal energy supply Legea nr.325 / 2006 Legea serviciului public de alimentare cu energie termica.

Secondary legislation:

- Ordinance 233 / 2004 for approving the regulations on metering of consumers connected to centralized public system of thermal energy supply Ordin nr. 233 din 30 august 2004 pentru aprobarea unor reglementari privind contorizarea consumatorilor racordati la sistemele publice centralizate de alimentare cu energie termica;
- Ordinance 343 / 2010 for approving the Technical Norm on energy consumption allocation between consumers from condominium type buildings, in case of using heat and hot tap water allocation systems Ordin nr. 343 din 13 iulie 2010 pentru aprobarea Normei tehnice privind repartizarea consumurilor de energie termica intre consumatorii din imobilele de tip condominiu, in cazul folosirii sistemelor de repartizare a costurilor pentru incalzire si apa calda de consum.

3.24 Slovakia

The heat allocation rules in Slovakia are defined in the Heat Energy Act (Act 657/2004 coll.)⁶¹ and its related secondary regulation⁶².

Starting from January 2017, the same rules apply for the heat produced directly in the building (with a central boiler) and the heat provided by a district heating systems⁶³. According to the rules described in the Regulation of the Ministry of Economy of the Slovak Republic No. 240/2016, the total heating cost is divided in two components:

- heating basic component is allocated over the floor area of apartments and non-apartment space; typically it is set to 60% of total heat, but agreement to other ratio is also possible;
- Variable component is allocated according to the amount of heat supplied to each apartment and measured by heat meters or estimated by heat cost allocators; typically it is set to 40%, but agreement to other ratio is allowed.

The application of correction factor to consider the disadvantageous position/orientation of flats in the building is allowed.

The same general cost allocation scheme is applied to the domestic hot water preparation, with a basic component set to 20% and a variable component to 80%.

Relevant regulation

- Regulation of the Ministry of Economy of the Slovak Republic No. 240/2016 Coll.;
- Heat Energy Act (Act no. 657/2004 Coll.) - January 1, 2005 to April 30, 2014;
- Act 251/2012 Coll. on Energy as amended, adopted on 31 July 2012 and came in force on 1 September 2012, not notified, but referred to in MNE(2014)57114, (Act 251/2012), <http://www.zakonypreludi.sk/zz/2012-251>
http://www.urso.gov.sk/sites/default/files/z_251-2012_en.pdf;

⁶¹ Act 657/2004 Coll. thermal energy as amended, adopted on 26 October 2004 and came in force on 1 January 2005, (Act 657/2004), not notified, but referred to in MNE(2014)57114
http://www.urso.gov.sk/sites/default/files/z_657-2004_sk.pdf

⁶² Regulation of the Ministry of Economy of the Slovak Republic No. 240/2016 Coll (not found on the web)

⁶³ Presentation of Kvetoslava Šoltéssová and Miloš Stašík (Slovak Innovation and Energy Agency) at the MBIC workshop in Warsaw on 14/11/2016 <http://mbic.eu/fileadmin/mbic/rce-warsaw/15-stastik.pdf>

- Act 657/2004 Coll. thermal energy as amended, adopted on 26 October 2004 and came in force on 1 January 2005, (Act 657/2004), not notified, but referred to in MNE(2014)57114, http://www.urso.gov.sk/sites/default/files/z_657-2004_sk.pdf.

3.25 Slovenia⁶⁴

In Slovenia cost allocation rules are defined and 50% - 80% of total space heating costs are distributed based on measured consumption - the remainder (20% - 50%) is distributed in proportion to dwelling size (see Figure 11) This latter amount represents the costs for the heat consumed to heat common areas and the heat that was not measured (e.g. heat released from vertical ascension pipes where radiators are equipped with cost allocators). Correction factors to consider unfavourable position of naturally colder flats are also applied.

In the case of domestic hot water, 50% - 80% of total costs are distributed based on measured consumption, the remainder according to the number of unit residents.

Along with several other Eastern European countries (e.g. CZ, HU), Slovenia introduced limits to the share of costs allocated to an individual unit. Limits were introduced in Slovenian regulation⁶⁵ in response to complaints about very high charges for some dwellings, and to remove incentives to save "excessively" on heating bills (i.e. to an extent where risks of damage to the building from under-heating/mold etc could arise). The maximum share of consumption is limited to 300% of the average. This value was determined on the basis of the statistical analysis of 4,500 dwellings, which showed the heating system in normal conditions cannot transfer more than 3 times the average heat per m². The minimum level of 40% of the average was set to remove any incentive to turn off the heating completely and reflects an estimate of the minimum consumption level necessary to keep the entire building at an adequate minimum temperature considered safe for the building. This way all occupants regardless of their actual behaviour can be seen as paying for that level of heating, and the consumption-dependent charge in turn reflect the additional heating required to reach the comfort levels they choose [2].

In practice, when consumption shares based on cost allocator readings (the amount accounting for 50-80% of the cost) are established, any consumption shares that are below 40% of the average per m² will be increased to 40% of the average, whereas any consumption shares that exceed 300% of the average per m² will be reduced to 300% of the average. In that way, owners who save excessively at the expense of their neighbours will pay a minimum cost for the heat that they receive passively from their neighbours and will be motivated to heat their apartment to a certain extent at least. On the other hand, it will not be possible for an individual apartment's costs to exceed the highest possible consumption. This methodology ensures that heating costs cannot vary by a factor of more than five (x5) per unit of surface area.

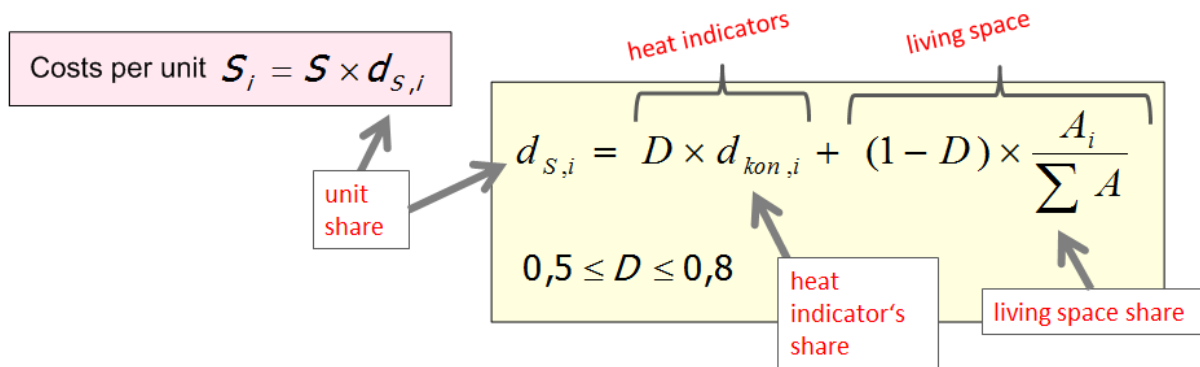
This way all occupants regardless of their actual behaviour can be seen as paying for that level of heating, and the consumption-dependent charge in turn reflect the additional heating required to reach the comfort levels they choose.

Dwellings for which consumption could not be measured, not because of a technical fault, but because the access is not allowed by the occupant or a device had been tampered with, are charged 300% of the average consumption.

⁶⁴ Section based on the information provided in the empirica guidelines report, References [2]

⁶⁵ Rules on the distribution and calculation of heating costs in residential and other buildings with several individual parts (<http://www.pisrs.si/Pis.web/pregledPredpisa?id=PRAV12408>), <http://www.energetika-portal.si/>, marko.suhadolc@gov

Figure 11. Space heating cost allocations rules in Slovenia⁶⁶



Relevant regulation

- Rules on the distribution and calculation of heating costs in residential and other buildings with several individual parts, Pravilnik o načinu delitve in obračunu stroškov za toploto v stanovanjskih in drugih stavbah z več posameznimi deli, Official Gazette of RS, no. 82/15, 61/16 ;
- The Energy Act , Energetski zakon. Adopted on 24 February 2014, published on 7 March 2014 on the Official Gazette, No. 17/2014, came into effect on 22 March 2014 (EZ-1) MNE(2014)51709 (Articles 49 , 174, 356, 357).

3.26 Spain

In Spain there is currently no regulation, apart from the mentioned below, on how metering and heat cost allocation shall be deployed leading to uncertainty in the market. A specific Decree is under preparation [2], but information on its contents is not available to the author.

Relevant regulation

- Real Decreto Ley 8/2014, 5 of July 2014, establishes a penalty regime for not complying with the obligation of installing measurement devices;
- Royal Decree 1751/1998 of 31st of July, updated with Royal Decree 1027/2007 of 20 July 2007 approving the Regulation on Building Heating Installations (updated by Royal Decree 238/2013 of 5 April 2013 amending certain articles and technical instructions of the RITE), establishes the obligation of install heat meters in all buildings built since 1998;
- Royal Decree 1618/1980, of 4 July and Ministerial Order Technical Instructions IT.IC of 16 July 1981. Established the obligation of installing warm water meters since November 1981.

3.27 Sweden

In Sweden, according to a legal requirement, if an individual heat metering system is installed, the costs for heating, cooling and hot tap water shall be based on the actual consumption. But, in most cases there is no individual metering. There are no legal requirements on how to allocate the costs in these cases. However, there is a practice commonly used that implies that cost allocation is based on the size of the flat, in relation to total square meters of all flats in a multifamily building.

⁶⁶ after dwelling orientation/position consumption correction

3.28 United Kingdom

In the United Kingdom, according to the Heat Network (Metering and Billing) Regulations (2014)⁶⁷, where heating, cooling or hot water is supplied from a district heat network to a building occupied by more than one final customer, the heat supplier must ensure that meters are installed to measure that heating, cooling or hot water to that building⁶⁸. Existing buildings are covered by the Heat Regulations and must register the scheme and have mandatory building level meters, where there it a multi occupancy level building. The duty does not apply if justified technical infeasibility criteria apply to meters or the deployment is not cost effective. Heat Cost Allocators shall be used in the alternative if cost effective. In the case of new buildings, sub-meters are mandated for billing under Part L building regulations. As new dwellings, these will be heat meters per apartment typically installed with individual apartment level Heat Interface Units.

Relevant regulation

- S.I. 2014/3120 - The Heat Network (Metering and Billing) Regulations 2014;
- S.I. 2015/855 - The Heat Network (Metering and Billing) (Amendment) Regulations 2015;
- Available at: <http://www.legislation.gov.uk/all?title=heat%20network>.

⁶⁷ http://www.legislation.gov.uk/uksi/2014/3120/pdfs/uksi_20143120_en.pdf

⁶⁸ or where one or more buildings are connected to an external network

4 Conclusion

The purpose of this report is to provide a systematic overview of the existing thermal cost allocation rules in Member States, characterising them in term of key features.

From the JRC assessment, in sixteen member States rules on the allocation of space heating or hot water consumption in multi-apartment buildings supplied from a central heating system have been put in place.

According to our analysis, the majority of Member States, introduced cost allocation schemes with a significant share (e.g. 50%-70%) based in metered consumption. This is in line with the current evidence that savings have been found in cases where a substantial proportion of costs have been allocated based on measured consumption. In some Eastern Countries (i.e. RO and SK), the share of fixed costs are higher than the average ($\geq 60\%$). This can be in part explained by their specific climatic and building stock conditions (e.g. higher average heating distribution system energy losses, limited individual heating control devices). Nevertheless, allocation rules with a low consumption based cost share can be an insufficient incentive for energy efficient behaviour and can limit the reduction of energy consumption in multi-apartment buildings.

Some Member States (i.e. AT, CZ, DK, EE, DE, HU, IT, NL and SI) allow for some flexibility in the choice of the distribution of variable/fixed costs (e.g. depending on dwelling size and level of consumption in the German case), that can be agreed, case by case, between landlord and final customer within certain limits.

Other Member States, i.e. IT and BG, use a different approach, dividing the heating expenses on the base of *voluntary consumptions*, measured with heat meters, and *non-voluntary consumption*, independent of user behaviour; the share of variable and fixed costs is thus calculated case by case per building. This method is more complex than the others and, for the Italian case, requires a building energy audit to be implemented by an energy expert.

In the majority of Member States analysed (i.e. AT, DK, FR, DE, HU, IT and SI) the same cost allocation principle used for space heating is applied to hot water consumption.

In order to take into account that in multi-apartment buildings, some dwellings are naturally colder due to their unfavourable location and that thermal energy can leak between the apartments, several countries include adjustment to their billing system in order to avoid that the move to an individual cost allocation system may be seen as unfair. Different countries apply diverse approaches to this heat cost allocation aspect (e.g. use of specific correction coefficients, introduction of minimum and maximum limits to the share of costs allocated to an individual unit).

The use of correction factors for the allocation of heating costs in multi-apartment buildings is mandatory in Denmark, Czech Republic and Lithuania, it is forbidden in Austria, Germany and Italy, while in France and Poland their application is voluntary.

The choice of correction factors can be important for how fair the allocation rules are perceived to be, and can have also an impact on the decision process at building level, e.g. on major building renovation measures. For instance, in the case of the renovation of an envelope in a multi-apartment building, the owners of the least energy performing apartments (e.g. at the top floor, north oriented, etc.) may be in minority in the decision making of the refurbishment. The introduction of billing correction factors can contribute to solve this adverse effect and to ease the transition from a centralized to an individual energy consumption accounting system or to minimise problems with split incentives between occupants in a building.

On the other hand, the use of poorly defined corrective coefficients (e.g. that compensate too much the different consumption of tenants) can be seen as unfair or significantly reduce the benefits expected from behavioural changes and tenants can be

less incentivised to reduce their energy consumption. These aspects should be considered when correction factors are defined in Member states.

To avoid that, following the introduction of individual thermal cost allocation rules in multi-apartment buildings, some dwellings had very high charge and to counter excessive attempts to save on heating bills (e.g. keeping all radiators turned off and taking advantage of the heat received passively from neighbours) some Member states (i.e. CZ, HU and SI) introduced limits to the share of costs allocated to an individual unit.

In this way, owners who save "excessively" at the expense of their neighbours will in any case pay a minimum cost for the heat that they receive passively from their neighbours and may be motivated to heat their apartment at least to a certain extent.

As regards common area heat cost allocation rules, some Member States (e.g. AT, DE, FR, DE, SI) include their heating costs in the total cost for heating and then allocate it to tenants according to the existing allocation rules (e.g. in Germany, 30% by living space and 70% by consumption); others (e.g. BG, IT and PL), distribute these costs according to individual dwelling property area (m²).

In order to enforce their application and prevent illegal behaviour (e.g. not allowing meter readings or meter tampering), well designed individual heat cost allocation rules should also include appropriate and effective penalties/incentives. For instance, in Slovenia, dwellings for which consumption could not be measured, not because of a technical fault, but because the access is not allowed by the occupant or a device had been tampered with, are charged 300% of the average consumption.

As a final remark, there is no one solution that fits all. Different thermal cost allocation methods shall be used in different countries considering their specific characteristics, in term of climate, building stock, typical heating distribution systems and user habits.

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- [2] Robinson S. (empirica GmbH), Guidelines on good practice in cost-effective cost allocation and billing of individual consumption of heating, cooling and domestic hot water in multi-apartment and multi-purpose buildings December 2016 https://ec.europa.eu/energy/sites/ener/files/documents/mbic_guidelines20170123_en.pdf

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