SAVE II ACTION Contract no. XVII/4.1031/ Z/99/283 Labelling and other measures for heating systems in dwellings

Appendix 8

Analysis of labelling possibilities

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SAVE II Labelling & other measures for heating systems in dwellings. Final Report Jan.2002 Appendix 8 - Analysis of labelling possibilities. IED, France

2.1	Main Objectives of this labelling	5
2.2	Direct outcomes.	5
2.3	Presentation of possible Labels	
2.4	Presentation of the labels and information included	7
3.1	Application	8
3.2	Information sheet	9
3.3	Type of organisation & Occasion for giving a label	9
3.4	Presentation of the label	9
3.5	Additional information	9
3.6	Main limits of this option	10
4.1	Application	11
4.2	Information sheet	11
4.3	Type of organisation & Occasion for giving a label	12
4.4	Presentation of label	12
4.5	Additional information	12
4.6	Main limits of this proposition	12
5.1	Application	13
5.2	Type of organisation & Occasion for giving a label	14
5.3	Presentation of label	14
5.4	Additional information	14
5.5	Major disadvantages of the proposition	14
6.1	Application	
6.2	Type of organisation & Occasion for giving a label	16
6.3	Presentation of label	16
6.4	Additional information	16
8.1	General process on the long term	
8.2	First step: labels on new oil and gas boilers	20
8.3	Modified proposal	20

1 Introduction

This task concerns the analysis of different ways for labelling Heating Systems in Dwellings.

Heating systems energy consumption in the 9 countries under this study (Denmark, Finland, France, Germany, Ireland, Italy, The Netherlands, Sweden, United Kingdom) accounts for 90% of total energy consumption by heating systems in the 15 EU countries (in 2000, the corresponding energy consumption was 1.64 PWh).

The energy consumption for space heating in dwellings is the largest component of energy consumption. And even if this consumption is decreasing¹, it still represents 69% of total European Union household consumption.

The context created by regulations on heating systems is detailed in Section 4, and can be summarised in the following points:

- the only European Directive in the field concerns minimum efficiency requirements for new hot-water boilers fired with liquid or gaseous fuels, including an European Star Label, which is not applied by all manufacturers,
- There is a project for a future European initiative on thermal regulations, but so far Thermal Regulations or Building Codes are national. These regulations concern only new buildings, therefore only new heating systems. One must keep in mind that in 2050, buildings already existing today will represent 2/3 of the total building number². Therefore, thermal regulations cannot be the only way to reach energy efficiency in as short or medium term.
- Norms of design and manufacturing on all components of heating systems.

Besides, the context of the market is as follows:

sesides, the context of the market is as follows

- Workers in Services (Design, Installation and Maintenance) even professional are not trained enough about Energy Efficiency. They are the main promoter next to the final consumer, but they generally promote a certain type of technology and/or of energy source. There is no obligation for them to deliver specific information on energy efficiency.
- Manufacturers know how to improve their products, but develop their products according to financial possibilities and, the most influencing factor, according to their knowledge of the market. So, manufacturers adapt their products to the distribution strategy and to the demand of the consumer. Here is a main barrier to the diffusion of efficient solutions: the lack of suitable demand from the final user.

¹ In 1960, in European Countries, 97 millions of dwellings used 1,78 PWh; in 2000, 152 millions of dwellings use 1, 64 PWh.

² "Energy Labelling of Existing Buildings" – SAVE contract n° XVII/4.1031/Z/99-261 – 2000 – International Conseil Energie.

The main reason for introducing labelling schemes is precisely to overcome this barrier by delivering the appropriate information to the final users.

As shown in section 4, the main difficulties to construct a label are the diversity of heating technologies, of energy sources and the definition of the type of data, and how to obtain it, to be included in the label. This section presents several propositions of label, and tries to analyse their different advantages and limits.

"Labelling" seems to be one of the ways to give information to users in an appropriate form. In this report, the term "labelling" is used to describe the operation consisting of determination and presentation of this information to users. A new presentation form could be designed, but the existing one with letters G to A, applied in the energy context has more or less started to become common to the consumer who remains the main actor who needs information.

Considering the preliminary approach of each label options, no economical assessment was made.

2 Propositions of Labelling for Heating Systems

2.1 Main Objectives of this labelling

The main objectives of labelling development and application are:

- to stimulate the Energy Efficiency "market",
- to reduce the Energy Dependence,
- to give an information about the level of energy efficiency to the consumer,
- to stimulate the consumer to take care about his energy consumption,
- to limit all impacts linked with energy consumption on the environment.

The label will be directed to the final user, who will create a positive pressure on the whole market chain: architects, designers, owners, manufacturers, etc.

2.2 Direct outcomes

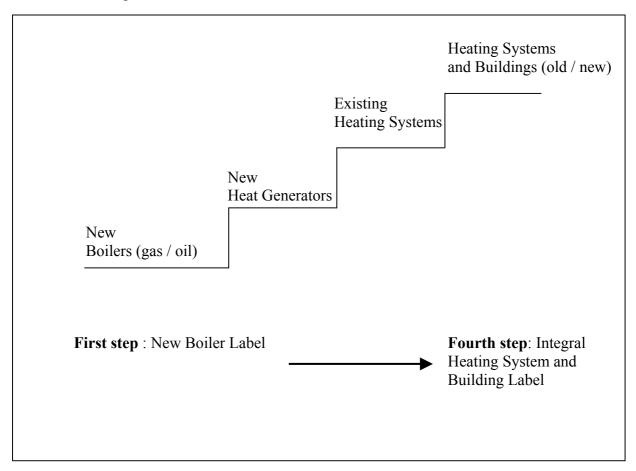
The benefits of the policy of label are:

- reduction of CO2 emissions & others pollution,
- reduction of energy consumption,
- higher degree of professionalism of the whole market operators, including installers, maintenance, etc.

2.3 Presentation of possible Labels

We will analyse several options for label to improve the energy efficiency of heating systems. Each of them takes into account the heating system (or a part of) and is based on the previous one, as follows:

- 1 "New Boilers" Label: This concerns newly installed boilers. The label indicates the nominal category of energy efficiency of the boiler. The label is delivered under the control of independent laboratories. An information sheet describes the best practice towards energy efficiency. This sheet is delivered to the consumer, and gives information on the heating systems (See chapter 3).
- 2 "New Heat Generators" Label: This label concerns newly installed heat generators of any energy sources. This operation is carried out under the control of independent laboratories. An information sheet describes the best practice towards energy efficiency. This sheet is delivered to the consumer, and gives information on the heating systems (See chapter 4).
- 3 "Existing Heating Systems" Label: The whole heating system, of any type of energy sources, is considered. All energy sources are considered independently. This operation could be carried out by independent experts or other authorised services (See chapter 5).
- 4 "Heating Systems and Buildings" Label: The label is extended to all heating systems (all energy sources), in new and existing buildings, and takes into account the thermal properties of buildings (see chapter 6). This scheme could be similar to existing building labels which have been developed in some countries.



This progressive way allows one to put in place a mechanism of providing information to the consumer. The second option allows to extend the labelling scheme to all energy sources used to heat space of dwellings. The third option takes into account, always in existing buildings, the whole heating system, of which the boilers and heat generators were previously labelled. This could be done by the use of specific tools (for example, software developed to apply the thermal regulation). The main objective of this third option is to allow to determine the parameters for the next and last option. The option 4 completes the previous one and includes the building features. This option concerns new as well as existing buildings and allows to also give information on the annual energy consumption according to the building features, climate conditions and number of occupants.

2.4 Presentation of the labels and information included

As it is proposed in the section 4, to be coherent with the other labels already designed and implemented for household appliances, it is recommended to use the same method of display. The letters system (G to A) will be proposed for expressing the performance level of components, of the whole heating systems or of the building. In some options, the label could be completed by the calculated energy consumption.

For option 1, the label is based on the performance level of the gaseous or liquid boilers. The level is determined according to the type of fuels and the technology of the boiler (condensing, low temperature, standard, back boiler).

For option 2, the label is based on the performance level of the heat generator. The level is determined according to the type of fuel or energy and the technology of the heat generator.

For option 3, the label is based on the performance level of the whole heating system. Each type of heating systems, according to the technology and to the energy source, has its own specific scale of label.

In option 4, the label concerns the performance level of heating systems and building. This label offers the possibility to give a label to different heating systems, independently of the technologies and the energy sources, on the same scale of label.

This scale, to take into account the complete heating systems with building features (including climate conditions and number of occupants) could also be wider than the actual one (G to A, means 7 levels for household appliances), for instance from L to A. This will depend on the level of description and precision required to define and to deliver the label.

In this option 4, the annual energy consumption could also be mentioned, but it is still very difficult to calculate. This additional information must be calculated by the way of a software and after determination of different parameters required to take into account the diversity of existing systems (which is the objective of option 2).

The different solutions are shortly described and an assessment of their respective relevance is given.

3 NEW BOILERS LABEL

The first level of labelling consists on giving an information about the level of energy efficiency of the newly installed boiler. The label is completed by an information sheet giving a best practice to ensure that the whole system will perform in an efficient way.

3.1 Application

This label would concern the heating systems with a new boiler, sold and installed in existing dwellings. It would be delivered only if a qualified professional installs the boiler.

The first step of this labelling process needs to be applied simply and to prove its efficiency. For this reason, some limitations are necessary as below:

- only individual and apartment block oil & gas boilers are included,
- the collective systems (district heating, CHP) are not included,
- the electric systems (heat pumps included) are not included,
- alternative fuels are also not included,
- existing boilers are not included,

The label is based on the energy efficiency of the boiler, which is variable according to the technology used. The different basic levels of label, according to the energy efficiency performance, have been discussed with organisations representing boiler manufacturers (for instance GFCC: Group of Manufacturers for Heating Systems: Groupement des Fabricants de Matériels de Chauffage Central par l'Eau Chaude et de Production d'Eau Chaude Sanitaire). A preliminary proposal, which could be a basis for further discussion with the profession representative entities, is the following:

Level of		Energy efficiency	(%) at part load	Technology
performance		30%		correspondent
		Gas	Oil	& Water temperature
higher level	A	$101 + \log{(Pn)} < A$	$99 + \log{(Pn)} < A$	Condensing; 30°C
second level	В	$97 + \log (Pn) < B <$	$94 + \log (Pn) < B <$	Condensing; 30°C
		$101 + \log (Pn)$	99 + log (Pn)	
third level	C	$87.5 + 1.5 \log (Pn) <$	$87.5 + 1.5 \log (Pn) <$	Low temperature; 40°C
		$C < 97 + \log{(Pn)}$	$C < 94 + \log{(Pn)}$	
fourth level D		$80 + 3 \log (Pn) < D$	< 87,5 + 1,5 log (Pn)	Standard; > 50°C
fifth level	Е	$ 76 + 3 \log{(Pn)} < E <$	Back boiler; > 50°C	

Pn: Nominal Power in kW

Note:

- the range of power output of boilers is from 4 kW to 400 kW.
- the level of efficiency depends on the fuel used; for gas or oil the scale is not the same; a distinction is carried out to take into account the difference of LCV between gas and oil from the level C to A.
- both levels F and G are excluded because of the level of requirement of the European Directive, and according to some national thermal regulation.

- the label does not include the level of performance of the auxiliary (pump and fan) of the boiler.

3.2 Information sheet

An information sheet will be associated to the label and describes the best practice to ensure the level of energy efficiency of the boiler. The information is delivered to the attention of the installer and the consumer.

The elements of information included in the information sheet could concern:

- Presence and state of control systems (thermostat, boiler interlock,...), and the quality and the performance of the emitters and distribution system. These systems must be in accordance with the relevant safety regulation and manufacturer's instructions.
- Procedure of installation which includes the method to size the boiler in order to meet the real needs of the consumer for space heating and hot water production. The adjustment of the speed of water pump must be included in this procedure.
- Maintenance contract to be applied to the heating systems in particular for control systems and boilers with high level of energy efficiency. In fact, such a contract is mandatory for safety and sanitary reasons, but not always accepted by the consumer.
- Information on efficient behaviour (openings, temperature control, intermittence, etc.).
- Information on auxiliary energy

3.3 Type of organisation & Occasion for giving a label

The level of energy efficiency of boilers is determined by laboratories according to a common methodology to be put in place in all European countries. The label would be delivered when a new boiler is tested by laboratories.

3.4 Presentation of the label

The label specifies, by the way of a letter (G to A), the level of energy efficiency of the boiler. The information sheet, elaborated to describe to good way to ensure the level of energy efficiency of the boiler, is associated to the label.

3.5 Additional information

- 1) Annual energy consumption for "reference cases"
- Delivering the annual energy consumption would be valuable for the consumer. This supposes to take into account the dwelling features, climate conditions, number of occupants, etc, which is not possible except if a "reference case" is designed.
- 2) Estimation of CO2 and other gaseous emissions must be treated as the annual energy consumption.

3.6 Main limits of this option

- 1) The label covers only one part of the components of the heating system: the boiler.
- 2) This first step is limited to gas and oil heat generators.
- 3) No comparison between different energy carriers
- 4) The label is limited to the new boilers. This is acceptable to put in place a labelling procedure, but still insufficient considering the life time of boilers.
- 5) The label does not take in account the building features.
- 6) This option allows only to give an annual consumption (in kWh/year) in a reference case. The reference case must be defined for each country, and even for each region.

4 NEW HEAT GENERATORS LABEL

After gas and oil boilers, the labelling scheme of heating systems can be improved through this second step, which includes all types of heat generators. This allows to take into account all types of energy sources.

4.1 Application

This label would concern all heat generators, newly installed in existing dwellings.

The aim of this step should be to give a label to the different types of heat generators. This approach makes a distinction between energy sources. The label is based on the level of energy efficiency of heat generation.

- For oil and gas boilers, as they are already labelled in the first step of labelling scheme,
- For the electric systems (heat pumps included),
- For heat generators using alternative fuels,
- For solid fuels boilers

It was not possible in this first approach to propose figures for each technology as in the option 1 (gas and oil boilers).

Two important points were the subject of discussions for this step. Both could make the label more accurate and complete, but also more complex to build.

- Auxiliary energy (pumps and fans) may be or may be not included in the label. It would obviously be an important progress to include auxiliary energy, but it also makes the label building process more complex, since it would require to define suitable testing procedure.
- It would be very interesting to have a label comparing different energy carriers through a common scale, including electric heating. This should be based on primary energy values. However, this is a tricky political question that would be very hard to solve in a short term, and that would delay any effort for label implementation. However, it must be said that an agreement on this question was found in Germany.

4.2 Information sheet

An information sheet will be associated to the label and describes the best practice to ensure the level of energy efficiency of the heat generator. The information is delivered to the attention of the installer and the consumer.

The elements of information included in the information sheet could concern:

- Presence and state of control systems (thermostat, boiler interlock,...), and the quality and the performance of the emitters and distribution system. These systems must be in accordance with the relevant safety regulation and manufacturer's instructions.
- Procedure of installation which includes the method to size the boiler in order to meet the real needs of the consumer for space heating and hot water production. The adjustment of the speed of water pump must be included in this procedure.

- Maintenance contract to be applied to the heating systems in particular for control systems and boilers with high level of energy efficiency. In fact, such a contract is mandatory for safety and sanitary reasons, but not always accepted by the consumer.
- Information on efficient behaviour (openings, temperature control, intermittence, etc.).

4.3 Type of organisation & Occasion for giving a label

The level of energy efficiency of boilers is determined by laboratories according to a common methodology to be put in place in all European countries. The label would be delivered when a new boiler is tested by laboratories.

4.4 Presentation of label

The label specifies, by the way of a letter (G to A), the level of energy efficiency of the generator.

The information sheet, elaborated to describe to good way to ensure the level of energy efficiency of the generator, is associated to the label.

4.5 Additional information

- 1) Annual energy consumption for "reference cases"
- Delivering the annual energy consumption would be valuable for the consumer. This supposes to take into account the dwelling features, climate conditions, number of occupants, etc, which is not possible except if a "reference case" is designed.
- 2) Estimation of CO2 and other gaseous emissions must be treated as the annual energy consumption.

4.6 Main limits of this proposition

The main character of this option may be seen as an advantage or as a limit. The separation of the generators per type of energy source and range of power makes impossible to compare one energy source with another one. But given the energy source, it allows to make the difference among various equipment. In each category, the highest level may be reached. As said in Section 4.1, the option to build a single label for all fuels on a primary energy basis would make the label building process more complex.

The other disadvantage is that this label scheme is limited to the heat generation. The other components of the heating system are not taken into account.

5 EXISTING HEATING SYSTEMS LABEL

This third step of the process labelling concerns the whole heating system. In the two previous steps, only heat generators are considered, the rest of the heating system is treated only through an "information sheet". This third step should allow to take into account the other components of a heating systems.

5.1 Application

In this label option, the different energy sources must be distinguished, but the methodological principle must be the same.

This allows for each type of energy source to reach the highest level of label. The comparison between the different energy sources will be introduced only in the 4th step.

As shown in Task 2.2., the energy efficiency of a heating system can be established according to the principle below.

Energy Efficiency Heating System					
$\eta_{HS} =$	$\eta_{\text{gen-an.}}$ · η_{distr} · η_{emitt} · η_{contr} · η_{aux}				
$\eta_{\text{gen-an.}}$ = Coefficient related to annual efficiency of generation system					
η_{distr}	= Coefficient related to distribution losses				
η_{emitt}	= Coefficient related to energy losses caused by the emitter system				
η_{contt}	= Coefficient related to energy losses caused by the control system				
η_{aux}	= Coefficient related to energy losses caused by the auxiliary system				

This methodology requires to evaluate each one of the coefficients. This method is close to the proposed methods in some national thermal regulations for calculating energy efficiency in new buildings.

When the building is recent and was built under the thermal regulation rules, it should be possible to collect the required information and to calculate the different coefficients.

When the building is older, an in-situ expertise would be required to determine the coefficients.

The advantage of this method is to create a link between the thermal regulations and the label, using the same calculations rules and tools (software).

However, evaluating efficiencies for each one of the components may be regarded as a difficult task, particularly for old buildings where the required information will be hard to collect. It is why another option should be explored, through a more qualitative approach, checking the quality of the components, state, installation, without calculating efficiencies by

themselves. The matrix for the evaluation should be elaborated taking into account the thermal regulation rules and tools, in order to reach a coherent evaluation.

5.2 Type of organisation & Occasion for giving a label

The label could be delivered by two different ways:

- by experts or consulting companies entitled by an independent organisation.
- directly by an independent control organisation.

The label could be delivered:

- when a new boiler heat generator is installed,
- or when a dwelling is sold,
- or periodically.

5.3 Presentation of label

The label specifies, by the way of a letter (G to A), the level of energy efficiency of the generator. A report should be added, making recommendations coming from the expertise. The information sheet, elaborated to describe to good way to ensure the level of energy efficiency of the generator, is associated to the label.

5.4 Additional information

The diagnostic required for delivering the label could be the opportunity for delivering information to the consumer or owner, about energy saving actions possible to implement, evaluating benefits and investment required. However, such a more ambitious diagnostic would be more costly.

5.5 Major disadvantages of the proposition

The aim of this label is to include the whole heating systems, included the distribution and emitters.

There is however a limit to the application:

- the new buildings might not be concerned by this labelling,
- the features of building are not taken into account.

In fact, this step leads to the next one.

6 HEATING SYSTEMS AND BUILDINGS LABEL

This label concerns the whole heating systems and buildings.

6.1 Application

This fourth label step is applied to all types of heating system (all energy sources included) and all types buildings (old and new). This means that the way to estimate the performance of heating systems includes the features of the building (envelope, climate conditions, size, number of occupants).

This option gives the possibility to take into account the case of dwellings heated by District heating or Combined Heat Power.

The label is determined after a diagnostic of the heating system taking into account the building features. This could be done by using tools (software or other methodology) of thermal regulation and /or building codes which are, at present, depending of each country.

The elements to take into account are:

- All components of the heating system:
 - o Generation,
 - o Distribution,
 - o Emission,
 - o Regulation.
- Features of buildings
 - o Insulation,
 - o Ventilation,
 - o Glazing,
 - o Solar exposition and geographic location,
 - o Size,
 - o Number of occupants.

According to the thermal regulations, the parameters to describe the features of new buildings are determined. Generally, they are used with an appropriate software. But, this option of labelling suppose to define also the parameters for existing buildings and especially for the oldest ones. This definition must be coherent with parameters for new buildings.

As in the option 3, the ideal scheme would be to quantify all parameters with the thermal regulation rules and tools, in order to define a common method for both existing and new buildings. But, an obstacle may be the difficulty to quantify all parameters in existing buildings. It may be easier to use a less ambitious method, through a diagnostic checking the quality of components, state, installation etc. and delivering the label through a matrix elaborated to be coherent with the thermal regulation methods.

The objectives of the diagnostic to be performed would be:

- to determinate the level of performance of the heating system,
- as an option, to determinate the level of energy consumption for heating,
- to give information to the consumer how to improve the efficiency and to reduce the consumption,
- to evaluate which level could be reached after improvement of the heating system,
- ideally to evaluate the costs for recommended actions.

6.2 Type of organisation & Occasion for giving a label

The label could be delivered by two different ways:

- by experts or consulting companies entitled by an independent organisation.
- directly by an independent control organisation.

The label could be delivered:

- when a new boiler heat generator is installed,
- or when a dwelling is sold,
- or periodically.

6.3 Presentation of label

A letter (G to A) must define the energy performance of the dwelling. The label must be presented by the way of a report delivering the additional information.

6.4 Additional information

The label gives the level of energy efficiency but it could be also possible to give some other information such as:

- 1) Estimation of annual energy consumption.
- 2) Estimation of CO2 and other gaseous emissions.

The diagnostic of heating system could also respond to the three following points:

- to define what are the actions to do and which level of efficiency can be reached if some assessment are possible.
- to know if the heating system is adapted to the needs of heating.
- to know if there is another solution cheaper and cleaner than the actual one (this solution must be available; this could stimulate District Heating / CHP or alternative fuels).

Ideally, it could be also possible to assess the cost of improvement of heating systems and advices to do it.

An information sheet on the necessity of maintenance contract, procedure of installation and maintenance of heating systems and others important information able to give more signification about the energy efficiency to the consumer could be added in the diagnostic report.

A more detailed investigation should evaluate the costs of implementing the different options.

7 SUMMARIZE OF PROPOSITIONS OF LABEL

The below table summarises the different propositions of label.

		Heating Sys	tems Labels				
		New Boilers		Existing Heating Systems	In All Buildings		
Application							
Building	New	no	no	no	yes		
	Existing	yes	yes	yes	yes		
Range of power of the heat generator	HS	yes	yes	yes	yes		
	For Apartment Block HS	yes	yes	yes	yes		
	For Large Collective HS	no	no	no	yes		
Energy and	Gas	yes	yes	yes	yes		
fuel	Oil	yes	yes	yes	yes		
	Electricity	no	yes	yes	yes		
	Other (RES,)	no	yes	yes	yes		
	, ,	Labelled c	omponents	l	1		
Whole Heating	Systems (HS)	no	no	yes	yes		
Boiler (efficiency level)	Energy efficiency for heating space	yes	yes	yes	yes		
,	Energy efficiency for auxiliaries	no	yes	yes	yes		
Control System	of HS	no	no	yes	yes		
Other componer	nts of HS	no	no	yes	yes		
Production of H	ot Water	no	no	yes	yes		
Building envelo	pe	no	no	no	yes		
		Information	on sheet on	T			
Contract Mainte	nance	yes	yes	yes	yes		
Metering		yes	yes	yes	yes		
Installation proc		yes	yes	yes	yes		
Maintenance pro	ocedure	yes	yes	yes	yes		

SAVE II Labelling & other measures for heating systems in dwellings. Final Report Jan.2002 Appendix 8 - Analysis of labelling possibilities. IED, France

Heating Systems Labels						
		New Boilers	New heat Generators	Existing Heating Systems	In All Buildings	
	Type of org	anisation & occ	asion for givii	ıg a label		
Organisation En	titled to do	yes	yes	yes	yes	
	Laboratory	yes	yes	no	no	
	Consulting	no	no	yes	yes	
Occasion for giving a label	New installation or replacement	yes	yes	yes	yes (new buildings)	
	Audit at the sale of building	no	no	yes	yes	
	Audit to x years	no	no	yes for collective buildings		
		Type of label pr	resentation			
Index	G to A	yes	yes	possible	possible	
Energy consumption	kWh	possible	possible	possible	possible	
Energy cost	€	no	no	possible	possible	
		ormation could	be given to th	e consumer		
Potential of energy saving		no	no	yes	yes	
Cost of improvement		no	no	yes	yes	
CO2 emissions		possible	possible	yes	yes	
SOx emissions		possible	possible	yes	yes	
NOx emissions		possible	possible	yes	yes	
others		no	no	yes	yes	
Legal status of labelling						
mandatory		yes	yes	possible	possible	
voluntary		no	no	possible	possible	

8 Conclusion

8.1 General process on the long term

One of the aims of this study is to explore how to implement labelling schemes to improve energy efficiency of heating systems in dwellings. The present section analyses some possibilities.

A four step process is proposed:

- 1 tests by laboratories for a label on "new boilers" (gas or oil),
- 2 tests by laboratories of "new heat generators" (boilers and other ones),
- 3 audit by an expert of "existing heating systems" (gas, oil, electric,...),
- 4 audit by an expert of "buildings" including heating systems.

Regarding the evaluation of heat generators (boilers and other ones: options 1 and 2), it is proposed to evaluate actual efficiencies under the control of independent laboratories. Each type of energy will have its own evaluation scale, which means that this labelling system does not allow the comparison between different energy sources. The label is associated with an information sheet, delivering suitable information to the final user and/or the installer who is installing and/or buying a new heat generator. The information concerns the best practice: how the equipment must be installed and maintained, how to use it, type of control system, etc. This allows to include the whole heating system in the label scheme and not only the heat generator, but without evaluating the actual heating system by itself.

The elements of information included in the information sheet could concern:

- Presence and state of control systems (thermostat, boiler interlock,...), and the quality and the performance of the emitters and distribution system. These systems must be in accordance with the relevant safety regulation and manufacturer's instructions.
- Procedure of installation which includes the method to size the boiler in order to meet the real needs of the consumer for space heating and hot water production. The adjustment of the speed of water pump must be included in this procedure.
- Maintenance contract to be applied to the heating systems in particular for control systems and boilers with high level of energy efficiency. In fact, such a contract is mandatory for safety and sanitary reasons, but not always accepted by the consumer.
- Information on efficient behaviour (openings, temperature control, intermittence, etc.).

Regarding the global evaluation of heating systems then of buildings (options 3 then 4), audits of actual installations will be required. It is proposed to explore in priority ways to make the label scale consistent with the national thermal regulations, using the same calculations rules, coefficients and tools. This would allow to have a consistent frame for both new and existing buildings, with the lowest level of the label based on the respect of the regulation, and higher levels going to better efficiencies. But in a first approach, such an option looks hard to implement: the quantification of all parameters required in those calculations may need a considerable work particularly in the case of an old building, with a consequent high cost for implementing the label. It is why another approach could be explored, less detailed, through a lighter diagnostic evaluating the quality of design, equipment, installation, maintenance. In any case, additional information could be delivered to the users showing the possible improvements of the heating system or the building, and their respective costs. The implementation cost of the label would depend on the level of detail the diagnostic would go to.

All of these labelling options must use the presentation of label (by using letters A to G) already used for all household appliances and now well understood and accepted by the European consumer. However, the consumer is more attentive to the level of consumption than the level of energy efficiency of products. It is why other valuable information for the consumer would be for instance the annual energy consumption or CO2 emissions. In options 1 and 2, the energy consumption could be calculated for a "dwelling as a reference case". In option 4, the actual energy consumption of the dwelling could be an output of the audit.

8.2 First step: labels on new oil and gas boilers

To put in place this complex process, it seems advisable to progressively eliminate the obstacles. Therefore, it is recommended to implement the first step of the label, determining the level of energy efficiency only for new oil and gas boilers. Considering that the article 6 of the European Commission Directive 92/42/EEC is actually not applied by a large number of manufacturers, the next step is to go further to take into account their arguments and to overcome the obstacles met in implementing this label. A basis for discussion with manufacturers and their representative organisations is proposed as following:

Level of		Energy efficiency	(%) at part load	Technology
performance		30%		correspondent
		Gas	Oil	& Water temperature
higher level	A	$101 + \log{(Pn)} < A$	$99 + \log{(Pn)} < A$	Condensing; 30°C
second level	В	$97 + \log (Pn) < B <$	$94 + \log (Pn) < B <$	Condensing; 30°C
		$101 + \log{(Pn)}$	$99 + \log (Pn)$	
third level	C	87,5 + 1,5 log (Pn) <	87,5 + 1,5 log (Pn) <	Low temperature; 40°C
		$C < 97 + \log{(Pn)}$	$C < 94 + \log{(Pn)}$	
fourth level D		$80 + 3 \log (Pn) < D$	< 87,5 + 1,5 log (Pn)	Standard; > 50°C
fifth level	Е	$76 + 3 \log{(Pn)} < E <$	$80 + 3 \log{(Pn)}$	Back boiler; > 50°C

Pn: Nominal Power in kW

- the range of power output of boilers is from 4 kW to 400 kW.
- the level of efficiency depends on the fuel used; for gas or oil the scale is not the same; a distinction is carried out to take into account the difference of LCV between gas and oil from the level C to A.
- both levels F and G are excluded because of the level of requirement of the European Directive, and according to some national thermal regulation.
- the label does not include the level of performance of the auxiliary (pump and fan) of the boiler.

8.3 Modified proposal

A modification of steps 1 and 2 as described above was also proposed, as a result of our German partner's industry contacts, also from normal practice in Germany under the new Energieeinsparverordnung for comparing different fuels and including auxiliary electric consumption of heating systems (e.g for pumps etc.).

Many of our German partner's industry contacts express a wish for a single label on all fuels (including electric heating) based on primary energy. This could be achieved by following the principles of a norm that exists in Germany for comparing different energy sources in a comprehensive way. This norm uses average primary energy values (European, rather than German, average primary energy values would, of course, be used).

Importantly, this would enable auxiliary electric energy consumption to be included in the label. (This can be significant, especially for new houses with high insulation standards, as high as 5 to 10 % of the total primary energy used by a heating system).

Steps 1 and 2 would therefore be modified to be a single label for all fuels on a primary energy basis (using European average primary energy values). This has the important advantage that the potential benefit of switching fuel for heating a dwelling is indicated by the label. Although separate labels for each fuel is easier because it avoids some difficult issues, indicating the potential benefits of switching fuels is an important issue. As soon as adequate testing standards are available the electric consumption of the heating system could also be included in the label.

The label would have an associated information sheet as described in the first proposal, above, to ensure best practice, and to promote energy efficiency for the whole heating system. In addition the label would include information on the energy consumption of auxiliary electrical components, for example, those in gas and oil central heating systems.