

REPORT D3.2

**Report on a set of energy performance indicators
including adjustment methodologies to be used for
property valuation**

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II. Glossary

EC.....	European Community
e.g.	example given
EN.....	European Norm
EPC	energy performance certificate
etc.	et cetera
HIP	home information pack
kWh.....	kilo watt hours
SAP.....	Standard Assessment Procedure
SBEM	Simplified Building Energy Model
RdSAP	Reduced Data Standard Assessment Procedure

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1 Background and Aim

This report describes possible links between energy performance certificates or, in general, the energy performance of buildings and property valuation. In this deliverable, mainly the view of energy experts is involved. In further activities in work package 5, all views together should describe appropriate approaches how to link building energy performance and life-cycle costing in property valuation practise.

On the one hand, there are mainly three property valuation approaches: the income related approach, the cost related approach and the value comparison approach (details of these approaches are described in report D.2 which is the basis for this research).

On the other hand, there are rather new energy performance certificates that have been introduced based on the European Directive 2002/91/EC of the European Parliament and Council on energy efficiency of buildings. Generally, these certificates are different in each member state.

The overall aim of this paper is to identify substantial information which is available of the energy performance certificate and might feed the property valuation process. If possible and reasonable, a simple adjustment methodology will be developed in order to derive comparable indicators for property valuation, especially for the countries considered in this project.

2 Method of research

The methodical approach for research follows the steps described below:

- 1) Defining the points in the valuation approaches where energy efficiency could be integrated – potential links (based on report D.2 “working paper”);
- 2) Defining the information needed for property valuation in order to feed these links;
- 3) 3. Screening existing energy performance certificates to check if the information identified at step 2 could be delivered
 - a. Main data set of the energy certificate; prevailing output data = results of the energy certificate calculation (mainly categories A, B, E, F,G, H of DATAMINE data structure);
 - b. On the detailed level of the calculation of the energy performance certificate where all information on the building shell and installations are included = all input data to the energy certificate calculation (all categories of DATAMINE data structure);
 - c. List of proposed measures to improve the thermal-energetic quality of the building to a certain level.

For this purpose, the classification of energy performance certificates of report D3.1 will be taken into account.

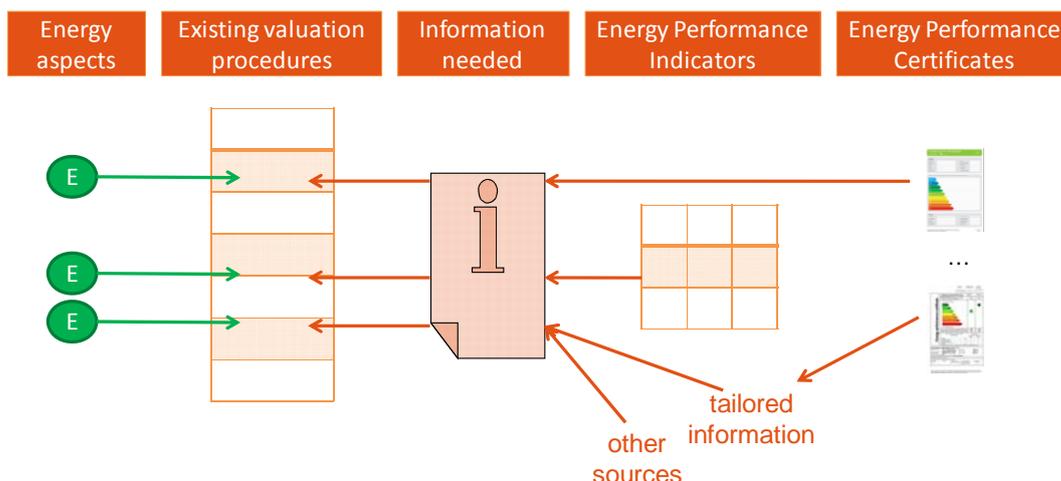


Figure 1: Methodical approach to integrate energy aspects in property valuation

For the screening of energy performance certificates that was done in deliverable D3.1 the following members states will be considered:

- Austria
- England & Wales
- Germany
- Norway
- Rumania

In Norway, the energy performance certification procedure is not finalised and thus not implemented yet. Therefore, Norway is not included in the assessment of energy performance certificates.

3 Integration of Energy Efficiency Indicators in Property Valuation

3.1 Possible starting points for integrating energy efficiency indicators

Based on the working paper of work package 2 at the following points and methods in the property valuation approaches energy efficiency indicators could be integrated.

	method	category	Experts' feedback
Income related approaches	Adjustment of the potential gross income	Market effect	If the amount of the operating costs is low, investors can realize higher bare rents. Additionally, the higher demand for energy efficient buildings will tend to lead to a lower vacancy rate in these buildings. +
	Adjustment of the all risk yield	Market effect	Theoretical possible but a very momentous lever - some tenth of a percent are sufficient for the adjustment. Attention: Avoiding redundancies 0
	Appreciation/ depreciation for value influencing characteristics	Market effect	Possible way, attention: avoiding redundancies. +
	Adjustment of the maintenance costs	Technical effect	No direct connection to the energy certification. -
	Adjustment of the residual life of the building	Manly technical effect	In general no direct connection to the energy certification. -
Cost related approaches	Adjustment of construction costs	Technical effect	Buildings of a high thermal quality cause higher costs and therefore lead to higher value. But this is manly independent from the introduction of the energy certification -
	Adjustment of the age of the building (accrued depreciation)	Manly technical effect	In general no direct connection to the energy certification. -
	Appreciations / depreciations for value affecting characteristics	Market effect	Possible, attention: avoid redundancies +
	Appreciations / depreciations for adjustment to the market value	Market effect	Possible, attention: avoid redundancies +
Value comparison approaches	Draw comparisons by using buildings of the same energy efficiency level	Market/ technical effect	In practice the availability of such highly comparable objects is rather uncommon +
	Appreciations / depreciations derived from the energy efficiency levels	Market/ technical effect	Experts favour this way of consideration +
	Adjustment of the value influencing characteristics	Market/ technical effect	Not favoured, this position is scheduled for very individual qualities of the property -

Table 1: Summary of the surveyed methods for integrating the energy efficiency (Source: work package 2)

3.2 Information needed for property valuation

Based on the information about certain parts of the valuation method that could be suitable to integrate energy efficiency indicators in Table 1, the information that is needed for property valuation is listed in Table 2.

	method	relevant information needed
Income related approaches	Adjustment of the potential gross income	Operation cost (including energy cost, maintenance cost etc.)
	Adjustment of the all risk yield	Thermal-energy quality (expressed in the label)

		category of the energy certificate and in other calculation results) as influence factor for the interest rate applied
	Appreciation/depreciation for value influencing characteristics	Factors with link to energy certification: <ul style="list-style-type: none"> • need for modernisation / maintenance • thermal-energetic quality (expressed in the label category of the energy certificate and in other calculation results) as potential factor for appreciation/depreciation
	Adjustment of the maintenance costs	Maintenance cost differentiated in <ul style="list-style-type: none"> • running maintenance • repair works In addition required modernisation to reach a given quality level (e.g. B-category in energy certificate)
	Adjustment of the residual life-time of the building	Construction year of the building and of its equipment
Cost related approaches	Adjustment of construction costs	Construction cost
	Adjustment of the age of the building (accrued depreciation)	Construction year of the building resp. of the technical equipment
	Appreciations/depreciations for value affecting characteristics	Factors with link to energy certification: <ul style="list-style-type: none"> • need for modernisation / maintenance • thermal-energetic quality (expressed in the label category of the energy certificate and in other calculation results) as potential factor for appreciation/depreciation
	Appreciations/depreciations for adjustment to the market value	
Value comparison approaches	Draw comparison by using building of the same energy efficiency level	Labels and other calculation results, that describe the thermal-energetic quality of buildings (in order to select comparable buildings)
	Appreciations/depreciations derived from the energy efficiency levels	Factors with link to energy certification: <ul style="list-style-type: none"> • need for modernisation / maintenance • thermal-energetic quality (expressed in the label category of the energy
	Adjustment of the value influencing characteristics	

		certificate and in other calculation results) as potential factor for appreciation/depreciation
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Table 2: Information needed to integrate energy efficiency indicators in property valuation

Summing up it seems that there exist the following different categories of information where the information potentially contained in energy certificates can contribute:

- General information of the thermal-energy quality of the building (expressed in the energy performance label or in other energy efficiency benchmarks) as influence factor e.g. for interest rate applied or appreciation/depreciation;
- Energy cost for the operation of the building;
- Maintenance cost differentiated in running maintenance and repair works (of the existing equipment without modernisation);
- Required modernisation to reach a given quality level (e.g. B-category in the energy certificate or the current standards for new buildings)
- Difference in energy uses resulted from an energy performance that is different from the current standards
- Life-time of the building and of its technical equipment

4 Analysis of the energy performance certificates to be used for property valuation

In this section the information that is available in the energy performance certificate to be used for the purpose of property valuation will be identified.

In chapter 3 the information needed for the purpose of property valuation is described. Now an analysis follows whether resp. in which way this information is available in the energy certificates taking into account the different parts of the certificate:

- 1) Main data set of the energy certificate; prevailing output data = results of the energy certificate calculation (mainly categories A, B, E, F,G, H of DATAMINE data structure);
- 2) On the detailed level of the calculation of the energy performance certificate where all information on the building shell and installations are included = all input data to the energy certificate calculation (all categories of DATAMINE data structure);
- 3) List of proposed measures to improve the thermal-energetic quality of the building to a certain level.

4.1 Austria

A	information potentially available in the energy certificate		
	B	C	D
information needed for property valuation	<i>Which kind of information is available in the energy certificate which could be used for property valuation in the proposed context (column A)?</i>	<i>In which part of the energy certificate this information is available?</i>	<i>Which kind of “process steps” need to be done in order to derive from the information available in the energy certificate (column B) to the information needed for property valuation (column A)?</i>
General information of the thermal-energetic quality of the building (as influence factor for interest rate applied or appreciation/depreciation)	Net energy demand for heating and cooling; yearly energy demand for heating, cooling, hot water, ventilation and light, overall final energy demand; energy performance indicator based on net heat demand;	In the first two pages of the energy performance certificate according to the official example.	
Energy cost for the operation	Final energy demand for	Different final energy demand in second	Energy sources have to be allocated to final

of the building	different energy uses. Energy sources as part of the selection of the energy generation of the building; Differentiation between direct energy use and auxiliary energy;	page of energy performance certificate; Energy source as well as selection of energy generation is part of the detailed calculation data (necessary for data input) that can be extracted of output files of calculation software.	energy demand of different energy use. Furthermore, energy tariffs have to be allocated that fit to the respective building.
Maintenance cost differentiated in running maintenance and repair works (of the existing equipment without modernisation)	No information available. However, data of the year of construction and initial start-up of building installation can give information about costs for maintenance and repair works.	Data about the age of the building and buildings installations are part of the detailed calculation. This information has to be used for data input and can be extracted of energy performance certificate software files.	Extracting information of building and building installations ages out of the detailed energy performance certificate files.
Required modernisation to reach a given quality level (e.g. B-category in the energy certificate)	Recommendations how to improve the energy efficiency to fulfil the requirements of the building code are included in the annex of the energy performance certificate.	Part of the annex, no further information about structure, content and amount is available.	Deriving trustful information about upcoming modernisation measures out of the energy performance certificate. Integration of additional modernisation measures besides improving the energy efficiency. Calculation of modernisation cost.
life-time of the building resp. of the technical equipment	Date of year of construction and initial start-up of building installations are available or available approximately.	These data is part of the necessary input date for energy performance calculation.	Gathering information of the age of the building and building installation out of the detailed energy performance certificate files.

Table 3: Available information in the energy performance certificate in Austria

4.2 England & Wales

	information potentially available in the energy certificate		
A	B	C	D
information needed for property valuation	<i>Which kind of information is available in the energy certificate which could be used for</i>	<i>In which part of the energy certificate this information is available?</i>	<i>Which kind of “process steps” need to be done in order to derive from the information</i>

	<i>property valuation in the proposed context (column A)?</i>		<i>available in the energy certificate (column B) to the information needed for property valuation (column A)?</i>
General information of the thermal-energetic quality of the building (as influence factor for interest rate applied or appreciation/depreciation)	Energy Efficiency Rating (SAP Rating), overall energy demand (kWh/m ² per year); Summary table of the building's energy performance related features with short description and assessment of important building elements.	Page 1 (indicators), page 3 (summary table of buildings elements)	
Energy cost for the operation of the building	Energy costs for lighting, heating and hot water (£ per year); each indicator is given as current and potential value.	Energy costs are calculated based on the total energy requirement for space heating, hot water and lighting multiplied by the respective fuel price according a table in the SAP Manual. Data on energy requirements of the system elements and fuel prices can be extracted from the standardised SAP Worksheet.	Energy sources have to be allocated to final energy demand of different energy use. Furthermore, energy tariffs have to be allocated that fit to the respective building.
Maintenance cost differentiated in running maintenance and repair works (of the existing equipment without modernisation)	No information available.	The reduced data version (RdSAP) is based on a set of age bands for the purpose of assigning U-values and other data. Default values e.g. on boiler efficiency are partly based on the data of construction.	Extracting detailed information on input data out of the calculation.
Required modernisation to reach a given quality level (e.g. B-category in the energy certificate)	Detailed recommendations based on a standardised list how to improve the energy efficiency of the building (divided in low cost, higher costs and further measures). The EPC includes also information on typical savings for each measure.	Part of the EPC (2-3 pages).	Calculation of modernisation costs (based on specific costs of each measure and dimensions of the building).
Life-time of the building resp. of the technical equipment	No information available.	Date of year of construction and initial start-up of building installations are not	Extracting detailed information on input data out of the calculation.

		included in EPC but could be found in the Home Information Pack.*	
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Table 4: Available information in the energy performance certificate in England & Wales (SAP Method for dwellings)

* The Home Information Pack (HIP) is compulsory for all homes on the market in England and Wales. It is a set of documents (including the EPC) that provides the buyer with key information on the property and must be provided by the seller or the seller's agent.

4.3 Germany

	information potentially available in the energy certificate		
A	B	C	D
information needed for property valuation	<i>Which kind of information is available in the energy certificate which could be used for property valuation in the proposed context (column A)?</i>	<i>In which part of the energy certificate this information is available?</i>	<i>Which kind of “process steps” need to be done in order to derive from the information available in the energy certificate (column B) to the information needed for property valuation (column A)?</i>
General information of the thermal-energetic quality of the building (as influence factor for interest rate applied or appreciation/depreciation)	Net energy demand for heating and cooling; yearly energy demand for heating, cooling, hot water, ventilation and light, overall final energy demand; primary energy demand, energy performance indicator based on final and primary energy demand; energy consumption for heating and domestic hot water, electrical energy consumption (depending on the type of certificate)	In the pages of the energy performance certificate according to the EnEV 2007.	
Energy cost for the operation of the building	Final energy demand for different energy uses and energy source is available.	In the pages of the energy performance certificate according to the EnEV 2007.	Energy tariffs have to be allocated to the respective energy source.
Maintenance cost differentiated in running maintenance and repair works (of the existing equipment without modernisation)	No information available. However, data of the year of construction and initial start-up of building installation can give information about costs for maintenance and repair works.	Data about the age of the building and buildings installations are part of the detailed calculation. This information has to be used for data input and can be extracted of	Extracting information of building and building installations ages out of the detailed energy performance certificate files.

		energy performance certificate software files.	
Required modernisation to reach a given quality level (e.g. B-category in the energy certificate)	Recommendations how to improve the energy efficiency are included in a separate form of the energy performance certificate.	In the pages of the energy performance certificate according to the EnEV 2007.	Deriving trustful information about upcoming modernisation measures out of the energy performance certificate. Integration of additional modernisation measures besides improving the energy efficiency. Calculation of modernisation cost.
Life-time of the building resp. of the technical equipment	Date of year of construction and initial start-up of building installations are available or approximately.	These data is part of the necessary input date for energy performance calculation.	Gathering information of the age of the building and building installation out of the detailed energy performance certificate files.

Table 5: Available information in the energy performance certificate in Germany

4.4 Romania

	information potentially available in the energy certificate		
A	B	C	D
information needed for property valuation	<i>Which kind of information is available in the energy certificate which could be used for property valuation in the proposed context (column A)?</i>	<i>In which part of the energy certificate this information is available?</i>	<i>Which kind of “process steps” need to be done in order to derive from the information available in the energy certificate (column B) to the information needed for property valuation (column A)?</i>
General information of the thermal-energy quality of the building (as influence factor for interest rate applied or appreciation/depreciation)	Specific yearly energy consumptions, expressed in kWh/m ² , for heating, DHW, and AC, as final energy uses.	Front page	Summing up the different final energy uses (e.g., heat, electricity, natural gas) and comparison with the reference building are also analysed on the certificate.
Energy cost for the operation of the building	Final thermal energy needed for heating and DHW; final electrical energy needed for lighting, ventilation and AC.	Front page	Energy uses are multiplied with appropriate tariffs to provide annual cost for energy consumptions.
Maintenance cost differentiated	Explicit penalties given	Back page	The maintenance costs

in running maintenance and repair works (of the existing equipment without modernisation)	in building energy evaluation for maintenance and use quality, expressed as multipliers greater than unity for the calculated energy needs.		may be estimated from the penalties values by applying the same multipliers to a new building maintenance costs.
Required modernisation to reach a given quality level (e.g. B-category in the energy certificate)	General improvement measures are recommended with no indication of the resulting energy label, and no associated costs.	In an attached report	The recommended measures must be associated with costs in order to assess the influence on the property valuation.
life-time of the building resp. of the technical equipment	Year of construction and subsequent renovations; age and type of installations.	Front page and annex to the certificate	The life-time of building and installations can be inferred from experience or comparison with similar buildings/installations.

Table 6: Available information in the energy performance certificate in Romania

5 Conclusion

The analysis of the energy performance certificates included in this study indicated various information that may be used in property valuation. Some information is explicit and ready to use; some information is implicit and a simple calculation is needed to make it usable. Generally, the energy performance certificate provides information such as:

- **General data on the energy quality** of the building (energy use indicator, energy label, energy mark) that positions the building within a certain range where the existing building stock lies currently; for example: on a scale A to G, a building with label B is above the average, close to the highest standards, while a building with label F is clearly a poor quality one in the stock. The building value is influenced/assessed accordingly.
- **Energy cost level** for the operation of the building, expressed as a label that ranks the building within the existing stock, or in present monetary values that are readily included in any valuation calculation.
- **Difference in energy uses** between a real building and a similar one that complies with the current national energy standards. This indicates either how old is the building (having high operating costs), or how modern and efficient is above the minimum requirements (having low operating costs).
- **Year of construction and age of technical equipment**, which from the history of energy standards, plus depreciation, giving a hint about the building energy quality (operating, maintenance and repairs costs) relative to the existing stock, and also about the building remaining lifetime.
- **Modernisation costs** to bring the building at least to the current minimum requirements; such information is valuable in assessing the investment needed to be made sooner or later in order to diminish the risk of over-depreciation on the market.

How far the energy certificates really can deliver the above mentioned information to property valuation depends on the concrete design and contents of the energy certificate in a given country (see deliverable D3.1).

For certain data needed, it is easy to gather and tailor information out of the energy performance certificate (e.g. energy costs). For other useful data, there is limited information available. In conclusion, there is a lot of information available in the energy performance

certificates, although it is not always explicit data. Therefore, the proper use of energy data into the valuation procedure may rely on two approaches:

- Experts for energy performance certificates have to participate
- A certain standardised process or format has to be established to transpose information out of the energy performance certificate to fit to the property valuation calculation schemes.

Further information on the building energy quality could be gathered from the reports delivered as a result of obligatory inspections of heating and ventilation systems. Such reports are more detailed in what concerns the building installations performance, compared to the energy performance certificates (including extensions and/or annexes).

Summarizing up, it will be a challenge to gather all available data that is needed and to tailor this information in certain pieces relevant for property valuation. This could be done by special data transfer structures like specified in the DATAMINE project, or otherwise defined. WP5 will identify ways to include energy indicators into the property valuation calculation approaches, despite the non-uniformity of information provided in EPC of different countries and despite the implicit content of certain quantifiable aspects.

IV. Bibliography

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