Energy efficiency: an essential element for transparent residential valuation How homeowners can contribute to more reliable assessments

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Key words: Residential valuation, Energy performance, Information from homeowners

1. SUMMARY

In today's housing market, energy efficiency has become a crucial determinant of property value. Ensuring that this factor is transparently reflected in property valuation is therefore essential-both for the market and for public trust in government-assessed values such as the Dutch WOZ-value.

In the market for residential properties, energy performance certificates (EPC) have contributed to transparency by providing clear information to potential buyers.
In mass appraisal processes, such as those conducted for property taxation, energy efficiency should ideally also be taken into account. However, not all properties have an up-to-date EPC that accurately reflects their current condition.

To overcome this, a system has been developed that allows assessors to make a reliable estimate of a property's energy efficiency using a limited number of targeted questions. While this developed system is less granular than the 11-class system used in official Dutch EPC's, the five-level approach within this system is accurate enough for use in mass appraisal models.

By involving homeowners directly in the estimation of their property's energy efficiency, the valuation process becomes more transparent and participatory. This engagement is expected to enhance public confidence in the WOZ-values assessed by the government and strengthen the legitimacy of property taxation.

SUMMARY (optional summary in one other language in addition to English, e.g. your own language)

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2. ENERGY EFFICIENCY OF RESIDENTIAL PROPERTIES IS BECOMING INCREASINGLY IMPORTANT

There are several reasons why energy efficiency is becoming increasingly important to homebuyers. As a result, the current energy performance of a dwelling is playing a growing role in price formation in the housing market. Within Europe, this trend is reinforced by direct regulation, most notably the Energy Performance of Buildings Directive (EPBD), which sets minimum requirements for improving the energy performance of residential buildings in the coming years.

Although discussions are currently underway regarding potential relaxation of certain formal requirements, this is not expected to reduce buyers' attention to energy efficiency. Not only does the European Union seek to improve the energy performance of buildings through regulation, but mortgage lenders also exert significant influence. Increasingly, mortgage providers offer additional borrowing capacity for the purchase of energy-efficient homes. When buyers spend less on energy bills, more financial capacity becomes available for mortgage interest and principal repayments.

Ultimately, buyers are increasingly focused on total housing costs. Consequently, potential buyers are willing to pay more for homes with high energy efficiency, i.e., homes with low energy expenses.

2.1 European Energy Performance of Buildings Directive (EPBD)

The Energy Performance of Buildings Directive (EPBD) forms part of the Fit for 55 package under the European Green Deal. Several elements of this Green Deal are currently subject to political debate, as sustainability and climate policy have declined in priority within the European Union, primarily due to financial considerations and increased spending needs related to security in response to global instability.

Key Objectives of the EPBD

Primary objective: zero-emission buildings by 2050

The EPBD aims to transform the entire built environment in the EU into zero-emission buildings by 2050.

For new buildings this means:

- From 2030 onward, all new buildings in the EU must be zero-emission, meaning they are highly energy-efficient and produce no direct emissions from fossil fuels.
- This requirement applies to new public buildings as early as 2028.
- These buildings must meet high energy performance standards and may receive energy performance class such as A or higher, depending on additional criteria such as on-site renewable energy generation.

For existing residential buildings, the EPBD establishes pathways for progressive improvement:

- Member States must develop national plans to reduce the average primary energy consumption of existing dwellings.
  - At least a 16% reduction by 2030 compared to a reference year.
  - A 20–22% reduction by 2035.
- Ultimately, the entire existing housing stock must become zero-emission by 2050.

Energy performance certificates and improvement pathways

While the directive does not impose a uniform EU-wide obligation requiring all homes to achieve a specific energy performance class by a fixed year, it does promote greater harmonization and transparency:

- Harmonized energy performance classes or energy labels (A–G) and mandatory digital registration.
- Improved information disclosure at sale or rental.
- National renovation plans must include improvement pathways ensuring that homes achieve progressively better energy performance classes in line with reduced energy consumption.

In the Netherlands, the current system includes energy performance classes (labels) A through G, as well as A+, A++, A+++, and A++++, with A++++ representing a near zero-emission dwelling.

Additional requirements for renewable energy

The EPBD also includes requirements such as:

- Installation of solar energy systems, where technically and economically feasible, particularly in new buildings and major renovations.
- Gradual phase-out of fossil fuel boilers, with a target date around 2040.

2.2 Importance of Energy Efficiency in Mortgage Lending

Energy efficiency (as expressed by the energy label) has a significant and growing impact on mortgage lending in the Netherlands. Banks increasingly incorporate energy performance certificates into assessments of maximum borrowing capacity, interest rates, and lending conditions particularly following new national regulations introduced in 2024. Individual lenders may also apply supplementary internal models.

Impact on maximum mortgage amounts

Mortgage lending standards are adjusted based on the energy performance class (energy label) of the property:

- Homes with the highest labels (A++++), which are nearly energy-neutral, may qualify for up to € 50,000 in additional borrowing capacity.
- Homes with poor labels (E, F, and G) do not receive additional borrowing capacity for purchase, although extra borrowing may be allowed specifically for energy-efficiency improvements.
- Additional borrowing for energy retrofits

Borrowers may take out additional financing on top of the standard mortgage to improve energy efficiency. This applies both to existing homeowners and to buyers who plan to undertake energy retrofits immediately after purchase.

Energy performance class–linked mortgage interest rates

An increasing number of banks link mortgage interest rates to the energy performance class:

- Better energy labels correspond to lower interest rates.
- Interest rates may be automatically adjusted if the energy label improves during the fixed-rate period.

To qualify for these benefits, the energy label must be officially registered with the Rijksdienst voor Ondernemend Nederland (Netherlands Enterprise Agency, RVO). Absence of a valid label may negatively affect interest rates or borrowing capacity.

2.3 Buyer Preferences

Partly due to favorable mortgage conditions, buyers demonstrate a clear preference for homes with favorable energy performance certificates. This preference is reflected in sales prices, time on market, and search behavior.

Higher sales prices

Empirical studies show that energy-efficient homes consistently sell for higher prices than comparable homes with poorer energy labels, all else equal. While price premiums were once limited to approximately € 5,000, recent research indicates an average premium exceeding € 70,000 (approximately 17%) for homes with label A or B compared to otherwise identical homes with label G.

Faster sales

Homes with favorable energy labels generally sell faster, indicating higher demand.

Search behavior

Data from housing platforms such as Funda show that buyers increasingly filter searches by energy label, with a strong increase in searches specifically targeting A- and B-rated homes.

3. NTA 8800: MEASURING ENERGY EFFICIENCY IN THE NETHERLANDS

3.1 Background of NTA 8800

NTA 8800 is the legally mandated Dutch calculation method for determining the energy performance of buildings and forms the basis of energy performance classes or energy labels for both residential and non-residential buildings.

It provides a standardized, legally defined framework used for:

- Assigning energy labels (A++++ through G),
- Calculating energy performance indicators for new construction,
- Policy development (regulation, subsidies),
- Market applications (appraisals, mortgages, transactions).

NTA 8800 generates several energy performance indicators, including:

- Primary fossil energy use (kWh/m²/year),
- CO_2 emissions (kg CO_2/m²/year),
- Share of renewable energy (%),
- Heating and cooling demand, reflecting envelope quality.

These indicators collectively determine the assigned energy label.

NTA 8800 was introduced in 2021 to align more closely with EPBD requirements and to emphasize actual energy demand and CO_2 emissions. NTA 8800 provides a single, consistent methodology across building types and improves comparability between homes.

3.2 Measurement Methodology Under NTA 8800

Energy labels under NTA 8800 are based on standardized calculations using objective building characteristics and normalized assumptions regarding occupant behavior. They reflect theoretical energy performance rather than actual energy consumption.

Key principles include:

- On-site inspection by a certified energy performance advisor,
- Documentation of all relevant building and system characteristics,
- Calculation using specialized software and fixed assumptions,
- Determination of primary fossil energy use as the decisive indicator for labeling.

Standardized assumptions ensure comparability across dwellings.

Data categories

- Geometry and building envelope
- Heating, cooling, and domestic hot water systems
- Ventilation and auxiliary energy
- Renewable energy systems

Only certified advisors may issue labels, supported by verifiable evidence and subject to audits. Labels are registered with RVO and remain valid for ten years.

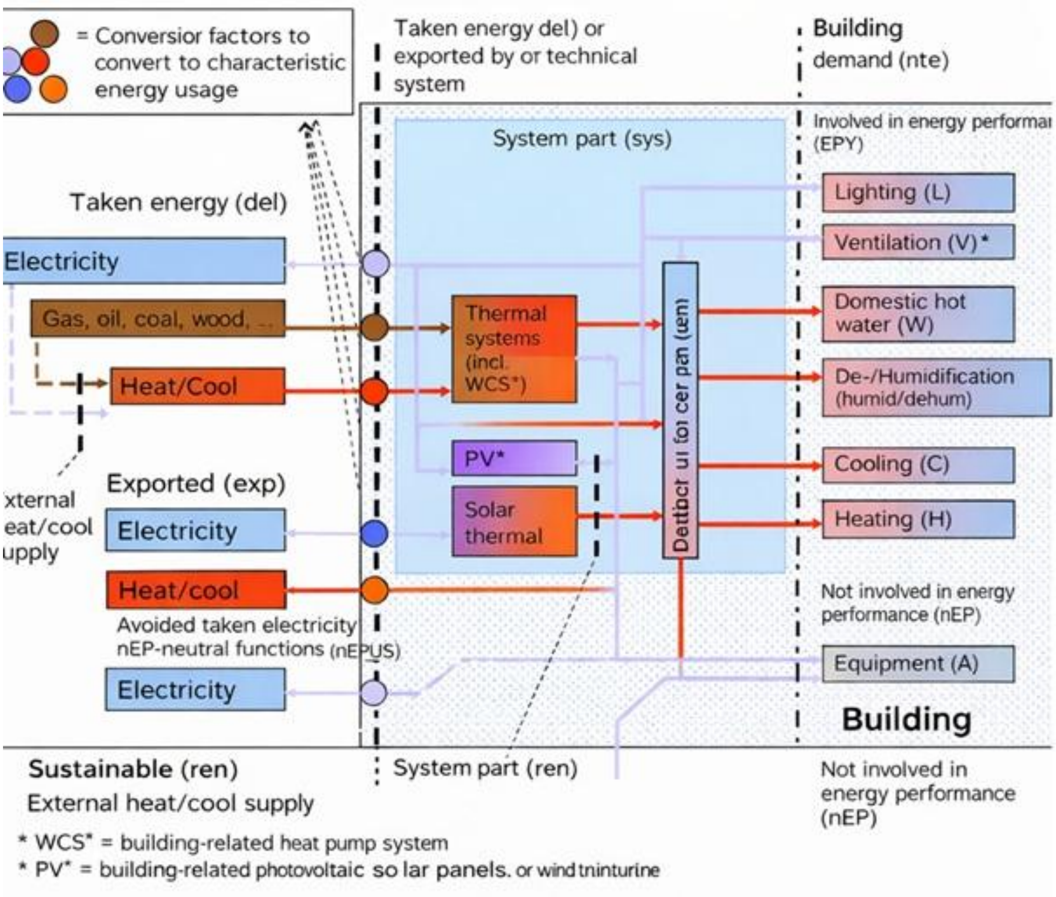


Figure 1: Illustration of the relationship between the different energy amounts (translated from NTA figure 5.1)

3.3 Conversion of NTA 8800 Results into Energy Labels

The energy performance class or energy label is derived from annual primary fossil energy use per square meter: If the fossil energy use per square meter is less than 0 kWh/m2/year (i.e. energy neutral), the energy label is A++++. But if the consumption exceeds 380 kWh/m2/year, the energy label is G.

Label	Primary fossil energy use (kWh /m^2 /year
A++++	< 0
A+++	0 - 50
A++	50 - 75
A+	75 - 105
A	105 - 160
B	160 - 190
C	190 - 250
D	250 - 290
E	290 - 335
F	335 - 380
G	> 380

4 ENERGY EFFICIENCY AS A CHARACTERISTIC FOR MASS VALUATION

The energy label determined under the Dutch NTA 8800 methodology provides an accurate and reliable estimate of the standardized (objectified) energy performance of a residential property. On the basis of this energy label, dwellings can be compared effectively for purposes of mass appraisal, for example in the context of property taxation. At the same time, an energy label represents the energy efficiency of a dwelling only at the moment of inspection. Once issued, an energy label remains formally valid for a period of ten years. During this period, substantial changes to the property may occur, particularly as a result of investments in energy-efficiency improvements.

As a consequence, a "valid" energy label is often not an accurate reflection of the current energy performance of a dwelling. Moreover, not all dwellings have a valid energy label at all. The relatively high share of outdated energy labels is largely explained by the fact that energy labels are typically issued in connection with the sale of a property. In many cases, however, purchasers undertake renovations—often including energy-efficiency measures—after acquisition but before occupying the dwelling. As a result, the registered energy label may no longer reflect the actual situation shortly after the transaction.

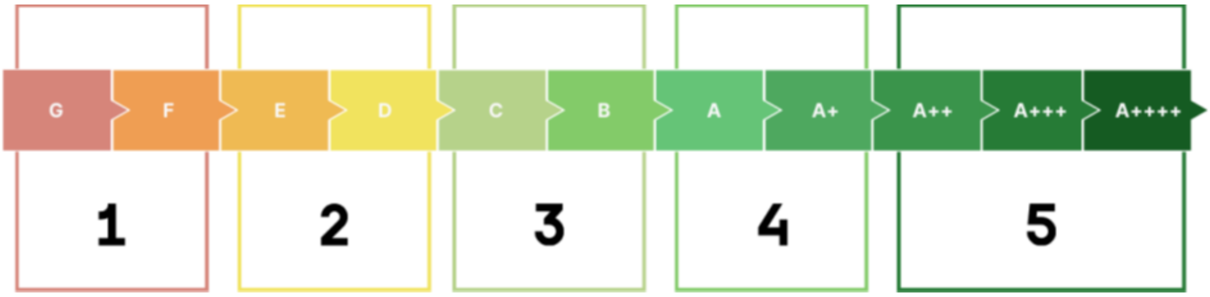
In the Netherlands, all residential properties and other real estate assets are appraised annually for tax purposes. The resulting assessed value (WOZ-value) is used not only for taxation but also for a wide range of other public and private applications. Annual valuation therefore requires reliable and up-to-date information on all properties subject to appraisal. This implies a recurring need for current information on the energy efficiency of the entire housing stock.

Annual determination of formal energy labels in accordance with the NTA 8800 methodology is infeasible due to capacity constraints among certified energy performance assessors and the associated costs. The cost of issuing an energy label for a single dwelling is approximately

€250, which is roughly ten times higher than the average cost of determining the annual WOZ-value.

At the same time, energy labels are playing an increasingly prominent role in the housing market. It is therefore sensible, when determining the WOZ-value, to incorporate an energy-efficiency characteristic that aligns as closely as possible with the logic of the energy label. The formal energy label system distinguishes eleven classes. For valuation purposes, however, this level of granularity is not required. In mass appraisal, other characteristics such as quality and maintenance are already assessed using a five-point scale. For reasons of consistency and practicality, the same five-point scale is therefore adopted for energy efficiency in WOZ-valuations.

By linking this five-point scale to the eleven energy performance classes, the transparency of the valuation process is enhanced while relying on information that property owners recognize and understand. Homeowners are typically active participants in the housing market and are familiar with observed transaction prices and the associated energy labels of comparable properties.



Under this approach, an average score (three points) for energy efficiency corresponds approximately to properties sold with an energy label B or C.

4.1 Components of a Pragmatic Assessment of Energy Efficiency

To arrive at a pragmatic yet robust assessment of residential energy efficiency, a framework has been developed based on the principles underlying NTA 8800. This framework distinguishes five core components, each of which is assigned a score:

Insulation	Windows (glazing)	Space heating systems	Domestic hot water systems	Renewable energy systems
1 - 5 points	1 - 5 points	1 - 6 points	1 - 5 points	0 - 5 points

By summing up the scores for all components, an overall energy-efficiency score is obtained. The minimum possible score is 4 points, and the maximum is 26 points. The total score is translated into a five-point energy-efficiency rating as follows:

Total score	Energy efficiency rating
4 - 7 points	**1**
> 7 - 11 points	**2**
> 11 - 15 points	**3**
> 15 - 20 points	**4**
> 20 points	**5**

Insulation
The insulation score represents a weighted average of the individual scores assigned to floor, wall, and roof insulation. Weighting reflects the relative importance of each element, which varies by dwelling type. For ground-oriented dwellings, roof insulation is weighted more heavily than floor insulation; for detached houses, wall insulation has greater weight than for row houses. In apartment buildings, the weights depend on the dwelling's position within the building (e.g., roof insulation is most relevant for top-floor apartments, while floor insulation is most relevant for ground-floor units).

Scores are objectively defined. For example, the absence of roof insulation results in a score of one point. A score of five points requires insulation with a minimum thickness of approximately 26 cm and a thermal resistance (Rc value) of at least 6.30 m^2K/W.

Windows (glazing)
For windows, the type of glazing in living rooms and bedrooms is decisive. Single glazing corresponds to one point, while triple glazing or vacuum glazing corresponds to five points.

Space Heating
Heating systems range from one point for individual gas heaters to five points for ground-source heat pumps. An additional point may be awarded if supplementary air-conditioning or cooling functionality is present, allowing for a maximum of six points in this category.

Domestic Hot Water
Domestic hot water systems are scored similarly. Gas-fired water heaters or electric boilers receive one point, while ground-source heat pump systems receive five points.

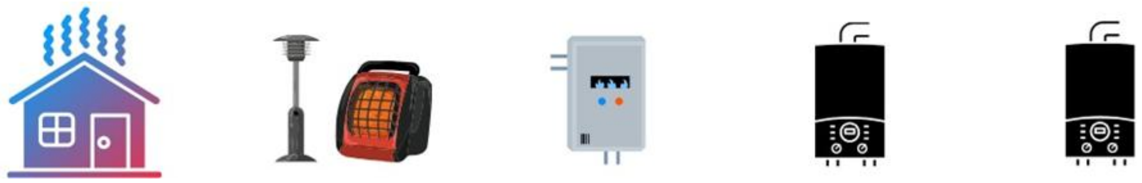
Renewable Energy
Between zero and five points may be awarded for renewable energy installations, such as photovoltaic panels (typically 0.5–2 points depending on number, age, and expected output), solar thermal systems, small wind turbines, or heat recovery systems.

Although this framework may give the impression that a relatively large number of characteristics must be collected for each dwelling, this proves to be manageable in practice.

On the basis of the year of construction, a filter can already be applied to prevent unnecessary and/or duplicate data from being collected, recorded, and assessed. Dwellings with a relatively recent construction year (for example, built from 2015 onward) generally have a higher baseline energy performance than, for instance, dwellings from 1930, because insulation requirements and other building standards have become significantly more stringent over time. For dwellings with a relatively recent construction year, collecting detailed data on insulation is therefore largely unnecessary.

For dwellings built in 2019 or later, it can essentially be assumed that they qualify for an energy-efficiency rating of 4 or 5. To determine whether a total score of 5 applies, the assessment focuses primarily on the installed systems, such as the type of heat pump and the presence of renewable energy installations. For the purpose of applying this pragmatic assessment of energy efficiency in mass appraisal, it is therefore advisable to organize data collection on residential energy performance on the basis of construction period classifications.

For example, with respect to space heating, the following assumptions may be used to estimate the type of installation originally present at the time of construction:



Space heating system	Individual gas heaters	Conventional gas boiler	VR, combination boiler	HR, combination boiler
	< 1965	1965 - 1974	1975 - 1998	> 1998

In this context, it is particularly important to assess whether upgrades or improvements have since been implemented.

Although the volume and complexity of the data required to determine this pragmatic assessment of residential energy efficiency are limited, much of the information involved cannot easily be observed from the exterior of a dwelling and is generally not available in generic datasets.

As a result, collecting and keeping this data up to date is realistically feasible only by involving the homeowner or occupant of the dwelling.

4.2 Involving the Homeowner in Determining Energy Efficiency

The data required for the pragmatic assessment of energy efficiency can be sufficiently standardized to allow them to be collected directly from the homeowner. By using a digital questionnaire and pre-existing information such as the year of construction and dwelling type, the questionnaire can be optimized and individualized. By filtering questions based on dwelling type and construction year, the original energy performance of the dwelling can be used as background information to avoid unnecessary questions and to prevent implausible responses. For example, in the case of a recently completed dwelling, the option “single glazing” would not be shown when asking about the type of window glazing.

Based on the original and plausible energy performance of the dwelling, responses can be prefilled and subsequently modified by the respondent if necessary.

At the start of the questionnaire, homeowners are asked whether the dwelling has a current, officially registered energy label. In most cases, this information is already available to the municipality, as all energy labels are stored in a national registry. However, the timing of energy-label registration may overlap with the request to complete the questionnaire.

If a recent energy label is available, the homeowner may indicate that the current situation no longer corresponds to the registered label, for example because energy-efficiency improvements were made after the label was issued. In such cases, completing the questionnaire remains useful. If the homeowner indicates that the current condition of the dwelling is still consistent with the energy label, further completion of the questionnaire can be omitted.

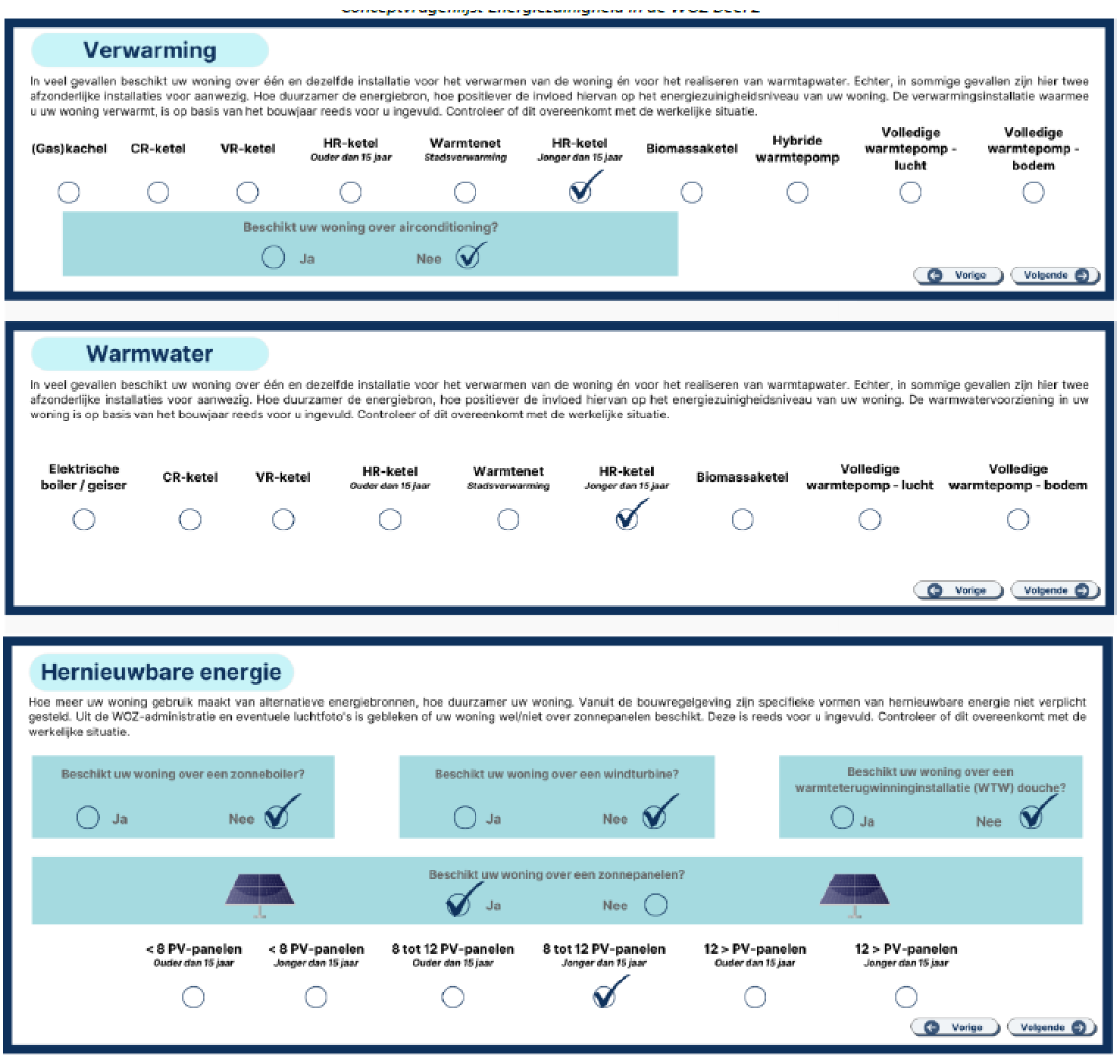


Figure 2: Part of the questionnaire om energy efficiency, topics space heating, domestic hot water and renewable energy sources

Questions related to insulation

Estimating insulation thickness and corresponding thermal resistance (Rc values) is too technical for many homeowners. Therefore, the questionnaire assumes a level of insulation consistent with the construction year of the dwelling. Homeowners are only asked whether post-construction insulation has been applied, meaning whether the floor, roof, or walls have been retrofitted with additional insulation. Such retrofitting is then translated into an upward adjustment of the insulation score.

Questions related to windows (glazing)
The questionnaire asks about the type of glazing, as this is generally known to homeowners or can be easily observed. It is highly unlikely that a dwelling is fitted with glazing that performs worse than the energy requirements applicable at the time of construction. Older glazing types are therefore not shown as response options, or a warning is generated if such an option is selected. For example, selecting “single glazing” for a dwelling built in 1990 is not considered a valid response.

Questions related to space heating
It has been shown that the age of a high-efficiency boiler plays a significant role in energy consumption and, consequently, in energy efficiency. The questionnaire therefore distinguishes between high-efficiency boilers younger than fifteen years and those that are older. As with glazing, implausible heating systems for a given construction period are either not shown as options or trigger validation warnings.

Questions related to domestic hot water
In many dwellings, the same installation is used for both space heating and domestic hot water. In some cases, however, separate systems are present. For this reason, these indicators are included separately in the questionnaire. Apart from differences in installation type, the absolute assessment of heating systems and hot-water systems is comparable. Once again, implausible options are filtered out based on construction year, and inconsistent combinations of heating and hot-water systems are not accepted.

Questions related to renewable energy sources
These questions focus primarily on identifying the presence of renewable energy systems. In particular, the capacity of photovoltaic installations is relevant. Requesting capacity in watt-peak terms is expected to be too technical for many homeowners. Therefore, the questionnaire asks instead for the number of panels and the year of installation. Other renewable energy systems are included only as yes/no questions.

5 CONCLUSION

Up-to-date insight into the energy efficiency of a dwelling is becoming increasingly important for achieving accurate valuations. The influence of energy efficiency on transaction prices is growing, partly due to government policies aimed at promoting higher energy labels and the financial benefits for homeowners, both in terms of mortgage financing and lower energy costs. Consequently, a current assessment of residential energy efficiency is also becoming increasingly important for mass appraisal purposes, such as property taxation through the annual WOZ valuations in the Netherlands.

A formal annual assessment of energy labels for all dwellings is not a feasible option for mass appraisal. The associated costs and the required capacity of certified energy-performance experts make such an approach impractical. Although energy labels are formally valid for ten years, relying on older labels is undesirable, as dwellings are frequently modified in the meantime, meaning that the registered label no longer accurately reflects the current situation.

For this reason, a pragmatic approach has been developed that simplifies the determination of an energy-efficiency indicator, requires fewer data, and relies largely on information that can be obtained from homeowners.

Research has shown that residential energy efficiency depends primarily on five indicators: insulation (floor, wall, and roof), windows, space-heating systems, domestic hot-water systems, and the share of renewable energy sources. By transforming these five indicators into a single energy-efficiency measure using a uniform, objective, transparent, and pragmatic assessment method based on a five-point scale—consistent with other valuation characteristics such as quality and maintenance—current energy-efficiency information can be incorporated into annual mass appraisal.

This methodology assigns an important role to homeowners as providers of the necessary data. In addition to improving feasibility for municipalities, this approach strengthens the connection between municipalities and residents in the execution of WOZ valuations. By incorporating current energy efficiency into the valuation process, assessed values better reflect market reality, and the valuation rationale aligns more closely with homeowners' expectations. Because homeowners themselves contribute to the underlying data, confidence in both the data quality and the assessed values is expected to increase.

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