Saving energy is not easy[1]

An impact assessment of Dutch policy to reduce the energy requirements of buildings

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Abstract

The Dutch Government stimulates the application of energy efficiency measures to reduce the energy requirements of buildings, which are responsible for about 20% of the Dutch CO_2 emissions. For our assessment, we followed a qualitative approach, due to a lack of data. We reviewed the mix of policy instruments and used stakeholder surveys and interviews. We found that energy use is not very likely to decline fast enough to achieve the Dutch policy targets for 2020. For new buildings, the policy mix works well, but its contribution to the policy targets is limited. For non-residential buildings the current Act, which obliges enterprises to take cost-effective measures, could be enforced to a greater degree. For privately owned homes a more compelling policy is needed. An alternative policy option would be to make taxation dependent on the energy label of residential houses. This would stimulate residents to take action while retaining the desired autonomy. For rental housing, binding agreements between municipalities and housing corporations may lead to more energy saving measures. Finally, we conclude that the Dutch energy tax is an important pillar of the current policy. It provides higher cost-effectiveness of energy saving measures and legitimates more strict energy efficiency standards.

Key words

Built environment, energy saving, policy assessment

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1. Saving energy will not be easy

The European Union's goal is to reduce CO_2 emissions by 20% by 2020, compared with 1990 emission levels. On a national level, the Dutch Government lowered its initial reduction target (Menkveld et al. 2010) from 30% to 20% (Klimaatbrief 2011). To achieve this target, the built environment is important. About 20% of all Dutch CO_2 emissions are emitted within the built environment (Vringer et al., 2014) from the use of fossil fuels, such as natural gas. The Dutch Government stimulates the implementation of energy saving measures in the built environment, fossil fuel is not declining fast enough on its own. There are many reasons why the energy saving rate is not as fast as desired; not even when energy saving measures bring important benefits, such as paying for themselves within a few years, offering added comfort, and reducing housing costs. Currently, owner-occupiers and tenants are sometimes unable to influence the energy quality of their buildings. They are insufficiently informed, lack knowledge, cannot carry out measures themselves, or they are not interested in making the effort. Moreover, builders are not inclined to build more energy-efficient buildings, as this may harm their competitive position. The financial advantage of future low energy bills is often underestimated by home buyers. They are not prepared to pay a higher price for a more energy-efficient house, even when the total housing costs would be lower (mortgage repayments plus energy bill). To help investors take saving measures and because of the long history of energy saving policy and existing political constraints, the Dutch Ministry of the Interior and Kingdom Relations (BZK) implemented a mix of policy instruments, including an energy tax, various subsidies and energy efficiency standards for newly constructed buildings (BZK, 2011). Dutch policy is of course in line with the EU Directive on the energy performance of buildings (EPBD).

The Dutch Ministry of the Interior and Kingdom Relations (BZK) requested PBL Netherlands Environmental Assessment Agency to make an impact assessment of the energy saving policy for the built environment. Their goal was not only to gain more insight into the effects of the policy, but also to obtain advice on how the policy could be made more effective and efficient. The central question to be answered in the assessment was: 'How can the government stimulate investments in energy saving measures in the built environment more effectively and efficiently?' To answer this question we formulated three research questions:

- To what extent are policy goals being achieved?
- How is the policy shaped?
- How does this policy influence investment decisions?

1.1. *Limitations of the assessment*

This impact assessment was limited to the policy as described in the "Plan of Action Energy Saving in Built Environment" (BZK, 2011). The objective of this plan of action is threefold:

- To contribute to the European target of 20% CO_2 reduction by 2020, by means of energy saving in the built environment;
- To use energy saving as a means of allowing people more control over the increase in their living expenses;
- To use energy saving to boost the construction sector.

For this assessment, we focused on the CO_2 emission reduction target and related energy saving goals. The assessment did not address possible effects on housing costs, the construction sector (employment) or the financing of investments. Nor did we investigate the extent to which energy saving measures in the built environment would be more or less effective or efficient than those in other sectors, such as industry or traffic and transport. Furthermore, additional policy was excluded from the assessment, but is mentioned where applicable. In particular, the 2013 Dutch Energy Agreement for sustainable growth (Nationaal Energieakkoord; SER 2013) – signed by over 40 parties, including national, regional and local authorities, employer organisations and trade unions, nature conservation and environmental organisations, financial institutions and NGOs – was taken into account in our assessment of the target range, but we did not address any of the new or modified instruments named in the Energy Agreement.

2. Approach

We combined a judging and a reflective assessment (see also Teisman, 2002), given its objective. Thus, we tried to assess the policy's current efficiency and effectiveness. In addition, we also attempted to provide more insight into the obstacles that make policy instruments less effective, and/or into the reasons why one or more instruments could not be used in practice.

Figure 1 shows the policy chain, in which policy effectiveness is determined by its impact in relation to the policy target. Its efficiency is the impact in relation to the policy effort. A quantitative policy impact assessment is the quantification of the effectiveness and efficiency of policy instruments, by determining the effect of each policy instrument. Unfortunately, there were no recent quantitative ex-post assessments available for the relevant policy instruments. Moreover, interactions between the policy instruments made it very difficult, if not impossible, to determine the effectiveness of the individual instruments in the policy mix (Noailly et al., 2010; Tigchelaar, 2012). A Dutch parliamentary study came to the same conclusion (Parlementair onderzoek, 2012).

Therefore, we were unable to establish the effectiveness and efficiency of the individual instruments, nor could we analyse the effectiveness of the portfolio of policy instruments as a whole. To determine the effectiveness of all instruments together would have required reference scenarios from which the effects of the whole policy mix would be excluded. However, it proved unfeasible to construct such reference scenarios, because important policy instruments within the policy mix have already been applied for decades and have been introduced or subsequently adjusted at various points in time. Also, more recent ex-ante studies (Menkveld et al., 2012a and ECN et al., 2014) give only a partial insight into the expected effects from the whole portfolio of policy instruments as described in the Plan of Action Energy Saving in Built Environment (BZK, 2011), because the instruments they assessed were not fully comparable with those in the current portfolio.

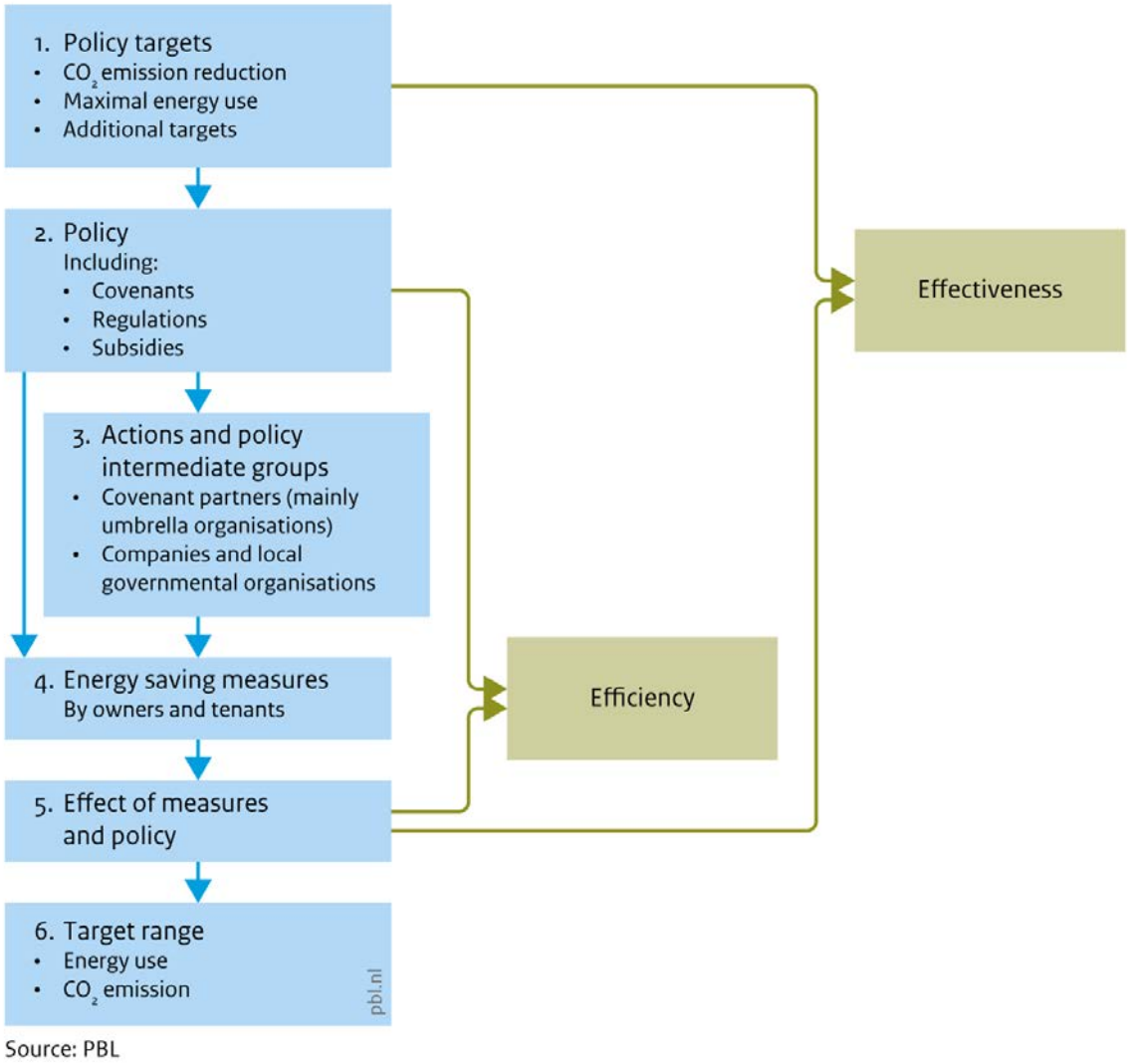


Figure 1. Policy chain for the Dutch energy saving policy for the built environment

Due to a lack of suitable data on policy effects (see Box 5, Figure 1), we conducted a qualitative assessment, focusing on the target range and the functioning of the policy instruments. To answer the research questions, the assessment included three parts:

- The target range. An overview of the target range, consisting of the policy impact on two key indicators: CO_2 emissions and energy requirements in the construction sector. This part of the assessment focused on Box 6 in Figure 1.
- An overview of the policy mix. An overview of the most important policy instruments and their interrelationships. As far as data was available from the literature, we included the effectiveness and efficiency per instrument. In addition, this article provides a discussion on the interaction between these and other instruments and certain other criteria of good governance. Subsequently, the mix of the instruments is discussed in relation to the target groups – those who decide whether or not to implement energy saving measures. Here, the assessment focused on Box 2 in Figure 1.
- Policy in practice; A description of how target groups make decisions to invest in energy saving measures, and the role of policy instruments. This description was based on two surveys conducted among (1) homeowners and tenants; and (2) building managers of non-residential buildings. In addition, over 30 interviews were held among stakeholders, such as umbrella organisations, intermediary businesses and housing associations, to explore their views and experiences. Here, the assessment focused on Box 4 in Figure 1 and the interactions between Boxes 2, 3 and 4.

3. Results

3.1. The Dutch target range

CO_2 emissions and energy consumption are expected to decrease, gradually, between 2012 and 2020. However, the intermediate policy target for 2015 was not achieved. Not enough energy saving measures were implemented in existing buildings. It is very unlikely that the CO_2 policy target for 2020 will be achieved (a maximum of 22.5 Mt CO_2), even when additional policy measures as described in the Dutch Energy Agreement (SER, 2013) would be taken into account. It is expected that CO_2 emissions will reach 24.7 Mt by 2020 (ECN et al., 2014).

The Dutch target for annual maximum energy consumption of 507 PJ by 2020 was based on the national CO_2 emission target and documented in the 'umbrella covenant' *Energy saving in the built environment* (Koepelconvenant, 2012). In 2008, for example, energy consumption was 603 PJ. The target for 2020, therefore, is unlikely to be achieved; the total energy requirement by 2020 is estimated at 521 PJ, about 14 PJ above the 2020 target (ECN et al., 2014). The difference may not seem very large, but is nevertheless substantial when considering the required effort to save the additional 14 PJ. And this is especially true given the ambition expressed in the Energy Agreement for sustainable growth to achieve an energy-neutral built environment by 2050 (SER, 2013).

The Dutch Government and other actors in this field are partners in the *umbrella covenant* (Koepelconvenant, 2012). The covenant states an absolute target, regardless of what happens. The benefit of an absolute target instead of a relative one is that it requires no reference scenario, which would be associated with uncertainties and involve possible disputes between the covenant partners. The target in the covenant is formulated as a maximum amount in building-related energy requirements, including the use of natural gas and electricity for heating, hot water and ventilation, and from which the production of solar home PV systems has been subtracted. This covenant concerns both energy efficiency and PV electricity. The covenant's target could be achieved, because of a fast increase in solar PV systems (now estimated at 20 PJ for 2020, instead of the initially estimated 2 PJ and changes in the energy statistics, which reduced the reduction target from 110 to 96 PJ (for 2008 the total energy requirement amounted to 603 PJ instead of the previously projected 617 PJ). The amount saved on the use of natural gas has been disappointing. This can partly be explained by energy saving measures, in practice, reducing 20% to 50% less energy than projected (Menkveld et al., 2012a, 2012b; Tigchelaar, 2010). This was possibly caused by a combination of a rebound effect, lower building quality, poor maintenance of installations, and model assumptions that were too optimistic (see e.g. Berben and Oomen, 2013; Majcen et al., 2013a; Laurent et al., 2013; Van Middelkoop, 2014). In addition to the overall covenant, three sub-covenants were entered into by government and umbrella organisations. Each covenant, with its own objectives and targets, contributing to the overall covenant:

- The objective of the *Covenant Building Energy-efficient* (Lente-akkoord 2012) was the application of higher energy quality standards for new buildings from 1 January 2015 onwards, which currently is on schedule. The higher standards will lead to a reduction of about 3 PJ by 2020 (Vringer et al., 2014) and is included in the overall reduction target of 96 PJ. The contribution is small because the number of new buildings expected between 2015 and 2020 is low, compared to the number of existing buildings.
- Although the energy index of social housing on average is declining, the pace of reduction has to increase, in order to meet the target of the *covenant Saving energy for the rental sector* (Convenant huursector, 2012),

an average energy index of 1.25, comparable with EU energy class label B. According to Vringer et al. (2014), a reduction of 23 PJ will be achieved. A number of private landlords have agreed to ensure that at least 80% of their properties will comply with label C (or higher) by 2020. This reduction is not quantified.

- In the *covenant More with less* (Convenant Meer met Minder, 2012), the committed parties agreed to upgrade the energy label of at least 300,000 houses per year, by two label classes. To date, this target has not been achieved. In recent years, about 200,000 houses have been improved, annually. If this trend continues, by 2020, around 12 PJ will have been saved in these types of houses (Vringer et al., 2014). However, because the annual number of houses that are being upgraded by only one label class is growing, these houses will contribute far more to the reduction target than those that have gone up by 2 or more label classes.

3.2. *An overview of the Dutch policy mix*

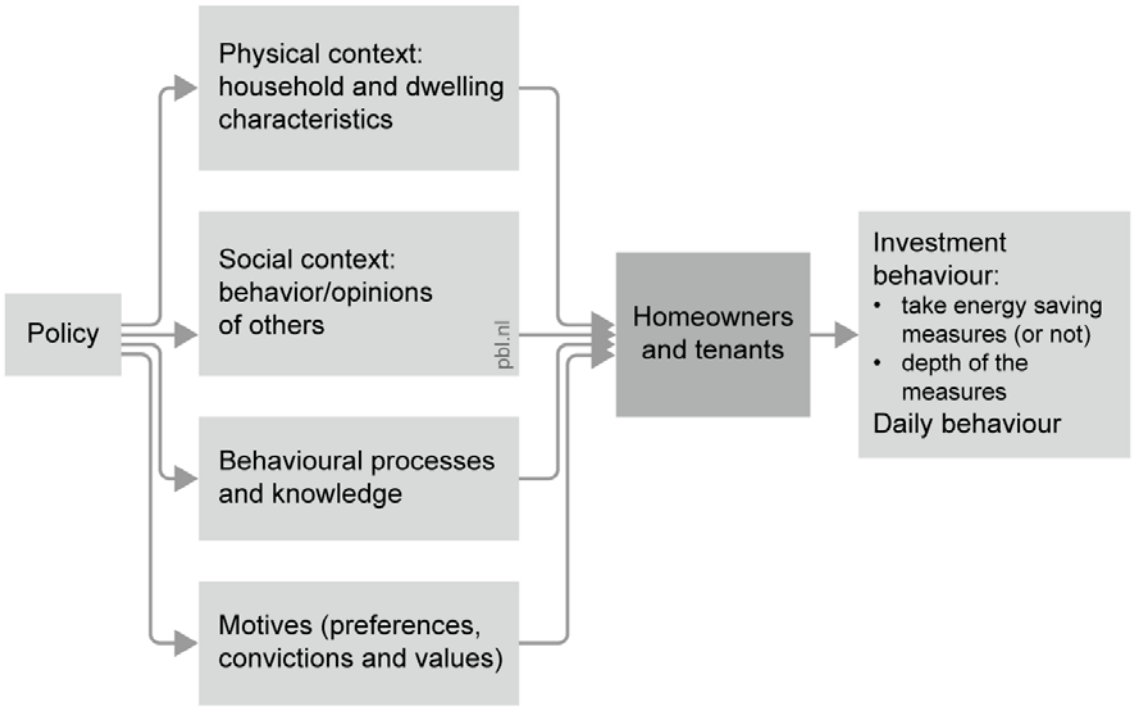
3.2.1. How does the energy saving policy for the built environment do its work?

To examine the effects of the energy saving policy on the choices of homeowners and tenants, we used a simple behavioural model based on the rational choice theory, taking into account the deviations on this theory (see Van Middelkoop et al. (forthcoming) and the schematic in Figure 2). This model has a certain overlap with the model as developed by the Dutch Council for the Environment and Infrastructure (Rli, 2014), which is designed for the development of policy. Rli uses four key factors to describe sustainable behaviour (abilities, motives, circumstances, and choice processes).

According to the rational choice theory, people make decisions by comparing the costs against the benefits of all available choices. It also assumes that people rank all possible choices in order of preference by using all the available information, have no time constraints and have the cognitive ability to weight all the alternatives. However, in practice, decisions are made using 'bounded rationality'; this means that not all the available information is taken into account and decisions are made within certain time constraints and are affected by cognitive limitations. Behavioural economic research suggests that individual behaviour deviates from rational behaviour according to the rational choice theory, because individuals have non-standard preferences (e.g. self-control problems and reference dependency), non-standard beliefs (e.g. overconfidence and the law of small numbers), and non-standard ways of decision-making (e.g. limited attention, menu effects and social pressure) (DellaVigna, 2007). For energy saving behaviour this means that:

- The decision whether or not to save energy depends on how people determine the costs and benefits related to this decision. Homeowners and tenants may have several motives for taking (or not taking) energy saving measures. What is important to them? And can the energy saving measures themselves contribute to these motives? Motives include issues such as comfort, security, financial considerations and the environment.
- Certain circumstances (the physical and social context) also impact the perceived costs and benefits. Here, the physical context refers to certain building features, such as tenure, amount of living space, construction year and housing type, as well as financial savings, net income, household size and subject knowledge. The physical context also includes the market for energy and energy saving products and services (e.g. availability, prices). The social context involves the opinion and behaviour of neighbours, family and certain enterprises.
- Finally, several behavioural processes lead to deviations from rational behaviour (see e.g. DellaVigna, 2007; Tiemeijer, 2011). For example, many people think that their monthly energy costs are negligible and decide not to insulate their houses, while in fact the average energy costs over 30 years represent about 20% of the price of an average house.

Figure 2 also shows that the decision-making process can be affected by policy instruments, directed to influence one or more of these factors. In practice, however, in most cases, policy efforts affect only the physical context. This is also the case for the energy saving policy on the built environment in the Netherlands. As in most neighbouring countries (OECD, 2007), the Netherlands uses a mix of policy instruments, described in the 'Plan of Action Energy Saving in Built Environment' (BZK, 2011). Most of the policy instruments are aimed to stimulate investment in energy saving in order to improve the energy quality of buildings.



Source: PBL

Figure 2. Behavioural model for energy saving behaviour of tenants and homeowners[2]

3.2.2. The rationale of the Dutch policy mix

According to economic theory and under ideal circumstances, it is efficient to use one policy instrument for one policy goal; for example, an energy tax applied to reduce the use of energy (see e.g. Tinbergen, 1967; Johnstone, 2003). Most of the time, however, circumstances are far from ideal. According to Bennear and Stavins (2007), for many situations, it can be efficient to use more than one instrument when there are political constraints (e.g. a lack of stakeholder support) or other market failures that cannot be addressed by a single instrument. In the built environment, the use of a policy mix is justified. There are multiple market failures and political constrains. The future financial gain resulting from energy saving measures is undervalued by homeowners. Prospective property buyers underestimate the future costs of energy and do not take into account the energy quality of buildings. Finally, in the rental sector, the benefits of a low-energy building do not go to the investor but to the tenants. To counteract these market failures, energy prices could be raised substantially by setting a very high energy tax, but this has met with political resistance.

In theory, the instruments within a policy mix can reinforce each other (OECD, 2007; Johnstone, 2003; Murphy et al., 2012a). According to Van der Doelen (1998), the policy mix must make use of a 'give and take' strategy to compensate for the weak aspects of the instruments, such as the combination of an energy tax and energy labelling system. The tax improves the payback time of energy saving measures, while labelling takes care of a more transparent housing market (OECD, 2007). However, policy mixes are not always more efficient than using only one instrument. For example, Braathen (2005) concluded that the use of voluntary agreements can reduce the effectiveness of other instruments. He also found a strong interaction between taxes or subsidies and legal enforcement. This combination supports stakeholders to achieve the desired behaviour, which also increases the efficiency of the applied instruments.

3.2.3. A brief overview of the Dutch policy mix

[2] Anchoring means that people get an idea of how much something should cost based on an given price. Loss aversion refers to people's tendency to strongly prefer to avoid losses rather than to acquire benefits.

To describe the Dutch policy mix, we selected the most important instruments that characterise it. The instruments can be divided into three types: financial, legal, and communication.

Financial instruments improve the payback time of energy saving measures. The main financial instruments are[3]:

- Energy tax (implemented since 1996). Today, about one third of the energy price paid by Dutch households and small companies consists of energy taxation (Vollebergh et al., 2014). The total amount of tax paid is partially compensated for by a fixed tax rebate. Despite the relatively low short-term price elasticity of energy (see Joosen et al., 2004), taxation is an important basis of the energy policy. The energy tax ensures a higher energy price and encourages investment in energy saving measures. Without the energy tax, many energy saving measures are not financially interesting to investors and the efficiency standard for new buildings is not cost-effective for buyers. In addition, the energy tax provides the Treasury with a substantial annual contribution. Electricity produced by solar PV home systems is exempt from energy tax.
- Other financial instruments are for example subsidies and tax deductions and rebates (1978). Some of the subsidies have been in use for decades, others only for a few months. Examples include subsidies on double glazing and solar PV systems, and personalised energy saving advice. In 2013, the national government decided to stop these types of subsidies[4]. Now they focus on cheap and easy loans by using revolving funds. For companies, several fiscal benefits are still available. For example, they can apply for tax rebates when they invest in specific energy saving measures. Financial instruments lower the required private investments and indirectly stimulate the demand, in turn lowering the price. The subsidies and fiscal benefits may also attract the attention of investors. However, there is always a group of people who would have invested anyway, irrespective of subsidies or other benefits. This group lowers the effectiveness of tax rebates and subsidies.
- The adjustment to the Dutch property valuation system (WWS) for the rental sector (2011). Landlords do not directly benefit financially from improving the energy performance of their properties, as an energy efficient building does not yield a higher rent. Tenants do benefit from a better energy performance, in the form of a lower energy bill. This split incentive has been an important barrier for landlords to invest. To reduce this effect, the national property valuation system was adjusted. With this system, the Dutch Government regulates the maximum rent of social housing[5]. The valuation is based on a property's physical characteristics, energy performance and location, while the valuation of the energetic quality is determined by the energy label.

L*egal instruments;* legal obligation to take energy saving measures. The most important legal instruments are:

- Higher standards for the energy quality of new buildings (1996). These standards were introduced because energy quality is not always a criterion for house buyers, despite the fact that this would bring down the total housing costs. From 1996 onwards, standards have become increasingly stricter and, by 2020, the net energy use in new buildings must be close to zero (nZEB level according to EPBD). Stricter standards are announced well in advance, in order to allow the construction industry to anticipate.
- Environmental Management Act (1993). Under this law, companies are obliged to use energy efficiently. Companies using larger amounts of energy are obligated to take energy saving measures that have a payback time of 5 years or less. In practice, many companies are not aware of this obligation or its consequences, and the law is insufficiently enforced. The participating parties in the Energy Agreement for sustainable growth (SER, 2013) have agreed to intensify the enforcement of this law, possibly in combination with an Energy Performance Assessment, comparable with the Dutch mandatory vehicle inspection.

The *communication tools* provide information, strengthen cooperation and stimulate innovation (e.g. labelling, voluntary agreements and innovation programmes). The main communicative instruments are:

- Overall voluntary covenant and three sub-covenants between government and stakeholders (2012). Since 1992, government and stakeholders have been entering into voluntary agreements to improve the energy efficiency in the built environment. Voluntary agreements are in line with a smaller and more facilitating

[3] A detailed description of all instruments can be found in Vringer et al. 2014 (in Dutch).
[4] Subsidies may still be available to homeowners on local or regional levels.
[5] With this system, the Dutch Government determines whether a rental apartment is part of the regulated part of the rental market (including the corresponding maximum rent level of currently about 700 euros), or can be part of the free-rental market where landlords are free to negotiate any rent level they deem reasonable.

public administration. In 2012, four covenants were signed or renewed: one overall covenant and three sub-covenants. For a description, see the above section on 'An overview of the target range'. According to all four covenants, parties may cease to participate without direct consequences. According to policy theory, voluntary agreements more easily lead to shared responsibilities and better solutions to common problems, compared to a policy in which the government arranges all (Murphy et al., 2012a). Although, in theory, voluntary agreements may work well, their effectiveness and efficiency is very controversial; especially if the agreement is not binding (Dijkgraaf et al., 2009).

- Energy labelling of buildings (2008). Since 2008, each building that is being sold, let or newly built, must carry an energy label, partly as a result of European legislation. Up to 2014, however, there was no sanction if such a label was lacking, and in most cases buyers and sellers agreed on the absence of an energy label, as they expected little benefit from it. But labelling and tailored advice provide prospective buyers with information about possible energy saving measures. Also, labels reduce asymmetric knowledge on the real estate market. Brounen and Kok (2011) found that buildings of high energy quality were being sold sooner and for a higher price. The participants in the Energy Agreement for sustainable growth (SER 2013) agreed that all Dutch buildings without an energy label would receive a temporary label, based on the year of construction and type of building. This label can be converted into a definitive label if the owner can show evidence of improvement of the energetic quality of the building.
- Innovation and stimulation programmes (2011–2012). The government entered into these programmes to know whether, and under what circumstances, a market approach could lead to comprehensive energy saving (BZK, 2011). According to policy theory, the market itself will not produce affordable solutions, due to the high costs and risks for individual companies and consumers. That is why innovation, learning, and pilot programmes are supported by the government. Two of such programmes have been elaborated in this assessment:
  - The 'Energy leap project' has initiated the development of highly energy efficient houses, both newly built and retrofitted. Currently (2014), several concepts are being worked out and builders, housing associations and the government agreed to renovate at least 11,000 social houses to turn them into zero energy buildings by 2020. The intention is to increase this number at least tenfold.
  - The 'Housing block project' financially supported market developments. Over 10 consortia of companies were supported for offering energy saving measures to a series of households living in similar houses. The assumption was that a serial approach would reduce the costs of the energy saving measures, so owners would be tempted to implement them. This assumption was found to be incorrect for owner-occupied houses (for a more detailed description, see Vringer et al., 2014).

3.2.4. Comparison with other countries

As mentioned above, there is hardly any data on the effectiveness of the individual policy instruments, nor on the policy mix as a whole. We found no comparable policy assessments on other EU countries, nor did we find any data on the effectiveness of such policy instruments in other countries. However, Geller et al. (2007) provides an overview, on a more aggregated level, of 30 years of energy policy in OECD countries. They mention that well-designed policies can result in substantial energy savings. They found that:

- voluntary agreements can be effective, especially in situations in which regulations are difficult to enact or enforce. However, the agreements also could be complemented with financial incentives and provided with technical assistance where needed, and, as an ultimate measure, there could be the threat of specific taxation or regulation being implemented.
- labelling, information dissemination and training may increase awareness and improve know-how about energy efficiency measures.
- government funded RD&D ultimately will contribute to the development of new energy efficient technologies.
- implementing minimum efficiency standards can be a very effective strategy for stimulating energy efficiency improvements on a large scale; especially if these are updated, periodically.
- financial incentives may increase the adoption of energy efficiency measures.

3.2.5. The Dutch policy mix and target groups

Figure 3 shows how the eight instruments discussed above are related to the target groups. Each target group is addressed by multiple instruments. Broadly speaking, the policy design seems to be a logical one. However,

communication tools hardly focus on the tertiary sector (in this case mainly related to schools, public health, offices, retail) and the legal instruments do not focus directly on the housing sector.

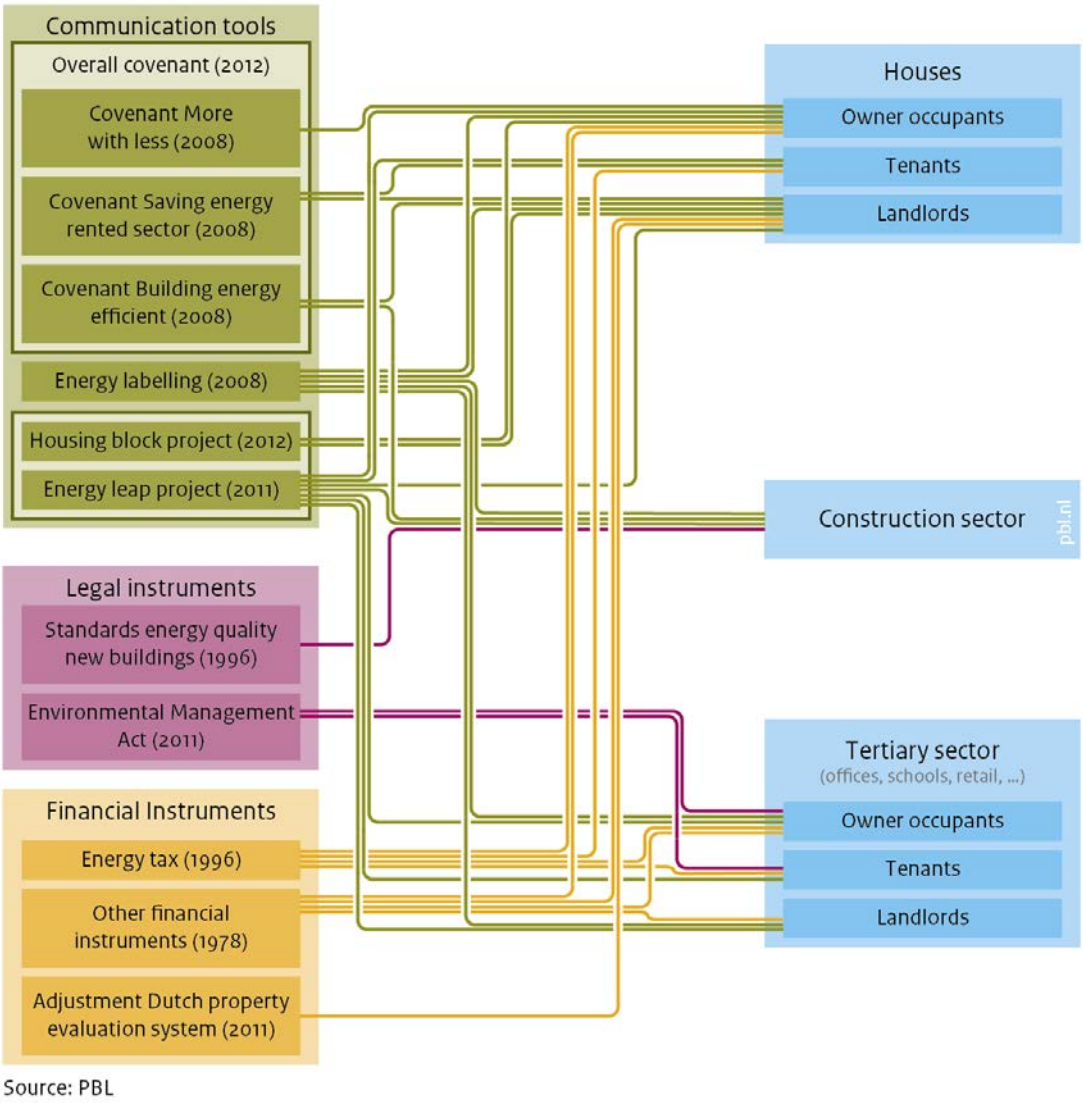


Figure 3. The relationship between the Dutch policy mix and the target groups

The construction sector

The construction sector has to comply with energy efficiency standards for new buildings, but their umbrella organisations have also signed a voluntary agreement to this effect. The standards oblige the sector to apply cost-effective energy saving measures. The energy tax improves the cost-effectiveness of a large number of measures. At the same time, the covenant helps the construction sector with cost-benefit considerations, knowledge, innovative pilot programmes and other types of support.

Housing

The mix of policy instruments for residential housing is aimed to:

- shorten the payback time for energy saving measures;
- initiate voluntary agreements in which the energy saving task can be shared between government, landlords and suppliers of energy saving measures;
- improve the supply of energy saving measures;
- reduce the 'split incentive' for the rental sector;
- make the market more transparent.

Financial subsidies encourage both homeowners and landlords. Tenants and owner-occupiers have to pay energy tax, which means that investment in energy-saving measures is attractive to both groups, from a financial point of view.

Owner-occupiers who sell their house are under the obligation to obtain an energy label for their property. The label informs potential buyers about the invisible energy quality of the property, thus making the real estate market more transparent. However, up to 2015, there was no penalty if this obligation would be ignored. Although the covenant 'More with less' focuses on homeowners, they are not a participating party. In this covenant, the government and the construction sector agreed to stimulate owners-occupiers to implement multiple energy saving measures. For landlords, energy saving is stimulated through subsidies, fiscal arrangements, the covenant '*saving energy in the rental sector'* and an adjusted property valuation system. The new version of the property valuation system reduces the 'split incentive', and ensures properties carry a mandatory energy label. To apply energy saving measures, landlords depend on cooperation from their tenants. The vast majority of tenants (70%) first has to agree to measures before they can be implemented, even if this would increase their rent.

The tertiary sector (schools, health care facilities, offices and shops)

The instrument mix that is focused on the tertiary sector is aimed to:

- shorten the payback time for energy saving measures;
- make the market more transparent;
- force larger companies to implement the energy saving measures with a payback time of less than 5 years.

The financial instruments for owners and tenants also apply to the tertiary sector. However, compared to households, companies that use large amounts of energy pay a much lower energy tax and, hence, energy price. Companies can also make use of fiscal benefits to reduce investment costs. There are no voluntary agreements for the tertiary sector. However, under the Environmental Management Act, companies that use large amounts of energy (more than 50,000 kWh or more than 25,000 m^3 natural gas, per year) are required to implement energy saving measures with a payback time of less than 5 years[6].

3.3. *Dutch policy in practice*

The central question, here, relates to how investment decisions are made, also taking the influence of policy instruments into account. To answer this question, we conducted an analysis, based on a broad view of the main policy instruments (see Vringer et al., 2014), an internet survey among pre-selected owners and tenants (involving 2267 respondents; for a detailed description, see Vringer et al. (2014) and Veldkamp (2014)), a telephone survey among 1000 building managers (for a detailed description, see Vringer et al. (2014) and Hoevenagel (2014)), and 30 interviews with housing associations, installation companies, builders, and umbrella organisations involved in the four covenants' negotiations (Hendriksen et al., 2014).

We found that, for owner-occupants, tenants, landlords and the tertiary sector, self-determination is very important; they would wish to decide for themselves when and how to take energy saving measures. However, they also were of the opinion that government involvement should be greater than it is today. Half of the surveyed homeowners said that they would agree with governmental regulations to make existing houses more energy efficient. Many owners-occupiers indicated that they had taken the initiative to implement energy saving measures themselves. Landlords considered the 'Convenant Huursector' an appreciated long-term objective, but ultimately wished to decide for themselves which goals would fit their organisation and over which period of time these goals should be achieved. Companies in the tertiary sector were found to be especially motivated from within their own organisation, although the government also was found to play an important stimulating role.

In general, financial return, payback time and financial means are important factors in investment decisions. We found that both rented and owner-occupied houses, in most cases, were made more energy efficient in a series of small steps, instead of one big step. Landlords said they saw tenants as a barrier. For energy saving projects in apartment buildings, more than 70% of tenants first would have to agree to an increase in rent. Financial considerations were found to play a role more often for tenants than for owner-occupiers. The tenants generally indicated that if landlords who wished to implement energy saving measures would provide them with a credible guarantee that housing costs (including energy) would not increase after implementation of these measures, they would be more inclined to agree to them. But there was also a large group of tenants for which the level of

[6] Examples are efficient lighting, highly efficient boilers, motion sensors or heat recovery from ventilation. It must be noted that payback times depend on the specific situation.

energy use of their home was not important at all; they were not familiar with the energy label or its role in determining their rent.

It is remarkable that energy taxation has its effect quite unseen. About one third of the energy price paid by owner-occupiers and tenants consists of energy tax. This makes the tax an important incentive for energy saving because more the energy saving measures become cost-effective for end users and legitimise energy efficiency standards. At the same time many owner-occupiers and tenants are unaware of the fact that they are paying this tax. And, in the absence of public debate on the subject of energy tax , the tax seems to have a rather high level of legitimacy. Housing associations and companies in the tertiary sector appreciate financial benefits (e.g. subsidies), provided that arrangements are long term and there are no restrictions on target groups. According to the literature (Noailly et al., 2010; Ruijs and Vollebergh, 2013) long-term arrangements are more effective.

Housing associations have integrated the energy label into their business operations. Homeowners tenants and parties in the tertiary sector have not adopted it as readily. Many are unfamiliar with the energy quality of their house or building. So, an energy label does serve a purpose otherwise many people would overestimate the energy quality of their building (see Figure 4).

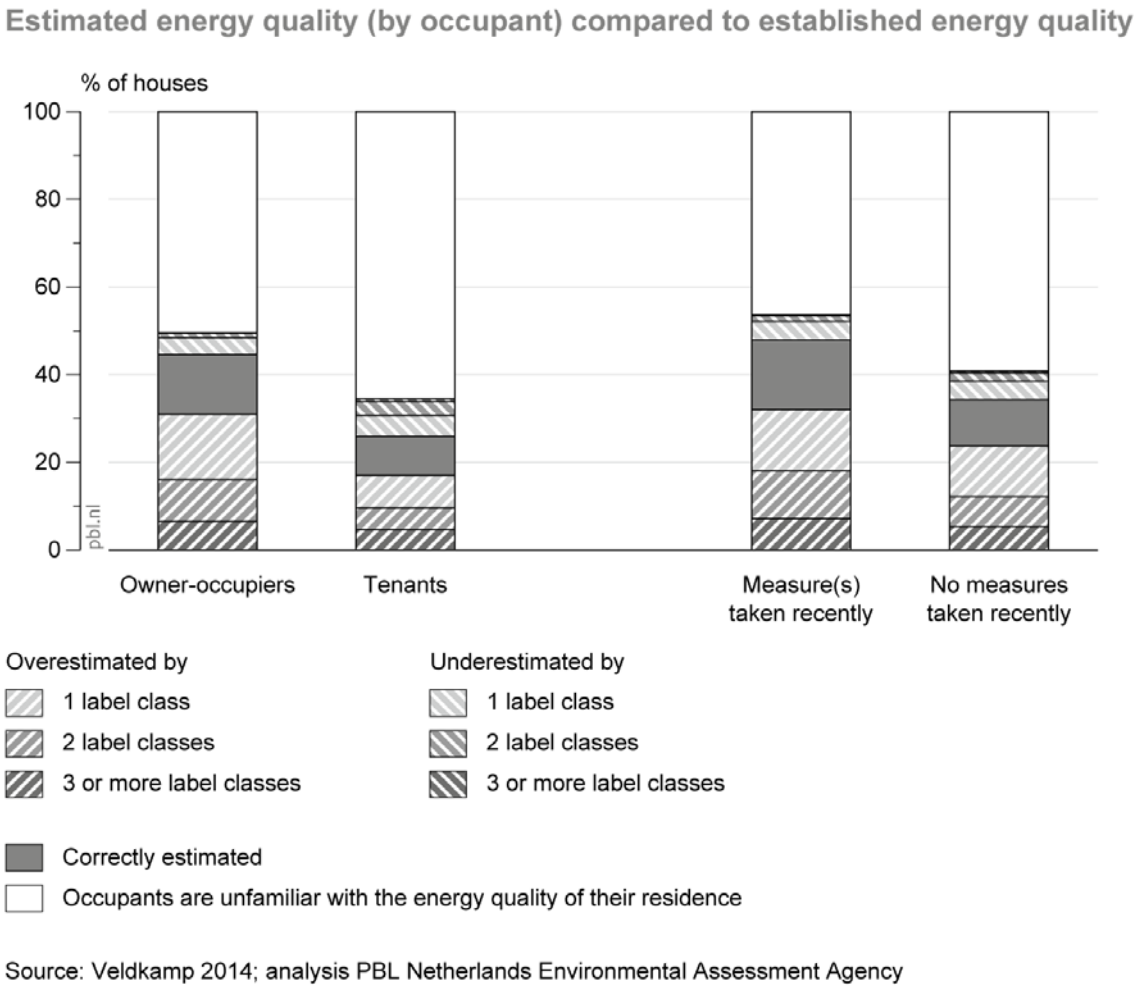


Figure 4 Energy quality overestimation by tenants and owner-occupiers

For new buildings, the combination of energy quality standards and voluntary agreements is effective. The energy tax legitimates more stringent standards. The required energy saving measures are cost-effective for investors.

For non-residential buildings, the combination of legal obligation and financial stimulation is insufficient to achieve policy targets (see Vringer et al., 2014). A better enforcement of the Environmental Management Act and more knowledge about energy saving may accelerate the pace at which energy is being saved. The tertiary sector would like reliable tailored advice from government services about energy saving.

For residential buildings, the combination of communication tools and financial incentives is also insufficient. The energy saving pace is too slow to achieve the policy targets. We have no indication of tenants and owner-occupiers being directly or indirectly stimulated by the covenants. Although the number of energy saving measures is rising, it is unclear whether this could partly be the result of the covenant *'more with less'* (Convenant Meer met Minder 2012). The target of this agreement, to increase the annual number of houses that have been improved by two or more energy label classes, has not been achieved. Although individual landlords indicated that they endorsed the goal of the covenant of saving energy for the rental sector (Convenant Huursector 2012), they personally did not feel bound to it.

The adjustment of the property valuation system gives landlords more possibilities to recover all or some of the costs of energy saving measures through rent increases.

The innovation and stimulation projects 'Energy leap' and 'Housing block' are and were focused on improving the energy quality of buildings. The government stimulated both the conventional approach (step by step) and an innovative approach (making one giant leap to achieve an energy neutral building). We found the exchange of experience that took place between these two projects to have been of value to improve the pace of energy saving.

4. Conclusions

Two contextual remarks are in order:

- In this evaluation, we were seriously hampered by a lack of available data to establish the effect and efficiency of individual policy instruments. A systematic assessment of impacts and efforts for each policy instrument, therefore, could not be made. Had this information been available, we would have been able to make recommendations to optimise the composition of the current set of instruments, on a quantitative basis. However, we were still able to assess the set of policy instruments as a whole, which led to clear results and recommendations. Furthermore, please note that if quantitative data about individual policy instruments had been available to determine which were the most effective, making the set as a whole more effective would not have been a case of simply replacing less effective instruments with more effective ones.
- This evaluation took place in close collaboration with the Dutch Ministry of the Interior and Kingdom Relations. This collaboration was very valuable, because the policymakers provided us with important information to use in the assessment. It also enabled the assessment to be tailored to the needs of the policymakers. This benefited the objective of the evaluation which was to provide more insight into the effects of the policy and practical advice on how it could be made more effective and efficient. Such close collaboration only has value if the evaluating party is able to act independently. PBL is a government organisation with a mandate to act independently, thus it is not financed directly by a particular policy department. This means that less desirable aspects could be worked out and unsolicited advice could be given.

In the built environment, large amounts of energy are being saved. The annual amount of energy required is estimated to decline by 82 PJ to 521 PJ, between 2008 and 2020. It is very likely that this pace is not fast enough to achieve the target for 2020. The CO_2 emissions associated with energy use are expected to decrease to 24.7 Mt by 2020, while the government target has been set at a maximum of 22.5 Mt. Reductions, particularly in the use of natural gas for heating in existing buildings, are lower than expected earlier; even when additional policy is taken into account. Given the ambition of the Energy Agreement for sustainable growth (2013) to have an energy neutral built environment by 2050, additional policy efforts are required.

Geller et al. (2007) provided an overview of 30 years of experience in energy policy in OECD countries. They found that, although voluntary agreements can be effective, they should be complemented with stronger incentives or strict regulations. Labelling and other information may increase awareness and improve the knowledge about energy efficiency measures; government-funded RD&D can contribute to the development of energy efficient technologies; minimum efficiency standards can be effective on a large scale; and financial incentives may increase the adoption of energy efficiency measures. These findings are in line with the more detailed results from our study of the specific Dutch situation.

In the Netherlands, the construction sector is on track to build more energy efficient buildings. The combination of legal obligation and the application of communication instruments is effective. Construction companies have to meet higher energy quality standards, which are legitimised through the energy tax. This is supported by a covenant that provides research, knowledge transfer and innovation experiments. Because the volume of new

buildings is small compared with the number of existing buildings, the energy saved in this field will be limited to 3 PJ by 2020, and therefore the most energy must be saved in existing buildings.

The pace of energy saving in existing buildings is slower than desired. To reach the policy target with greater certainty, this must be increased. Continuity and predictability of the policy will increase its effectiveness. In addition, policy may gain in efficiency taking into account not only financial considerations, but also behavioural processes, such as the underestimation of future benefits.

Owners and tenants of non-residential buildings (e.g. offices, shops, schools, health care facilities and hospitals) pay insufficient attention to energy saving. The Environmental Protection Act is widely ignored – both consciously and subconsciously. This is partly due to a lack of enforcement, and partly because, for many of them, energy saving is not a priority. Also, many lack knowledge about the applicability and cost-effectiveness of energy saving measures. In this respect, energy saving could be stimulated by a greater awareness among these owners and tenants, as well as by more stringent enforcement of the Environmental Protection Act. A reliable tailored energy saving advice may also help. The Energy Agreement for sustainable growth ensures a better enforcement. The proposed Energy Performance Assessment may help if the implementation of measures would become compulsory.

Energy saving in privately owned homes is progressing steadily. Homeowners are making improvements in small steps. But the policy instruments are too weak to stimulate energy saving measures on a larger scale. The Energy agreement for sustainable growth helps the development of more favourable financing conditions and provides in more information. Whether this will be sufficient to accelerate the pace of energy saving is debatable. Implementing a more stringent policy would be advisable if policy objectives are to be achieved. This assessment shows that half of the surveyed homeowners would favour more government involvement. They agree with government regulations to make existing housing more energy efficient. However, the introduction of standards is at odds with the desire of homeowners to decide for themselves when and how they take energy saving measures. An alternative policy option is to make existing taxes dependent on the energy label of buildings, without increasing the average tax burden. This would create more of an incentive for residents to undertake action while retaining their autonomy in being able to decide for themselves whether or not to take energy saving measures. Such a tax differentiation could be part of a broad tax reform that the Dutch Government is currently preparing.

For rental housing, housing associations endorse the goals of the *covenant saving energy for the rental sector*, and are willing to take energy saving measures, but they face financial barriers and cannot always convince their tenants of the need for such measures. That is why they prefer to set their own individual goals. The adjustment of the property valuation system makes it more attractive to invest in energy saving measures. This is one of the reasons why the average energy quality is expected to increase up to 2020. However, at the current pace, the goal of the covenant will not be achieved. For a faster improvement in the energy quality of rental housing, municipalities could enter into binding agreements with individual landlords about the goals to be achieved, instead of with their umbrella organisations. The housing associations could try to eliminate tenant resistance through a more customer focused approach, providing better information and credible guarantees that housing costs, including energy, would not increase after the implementation of energy saving measures.

Finally, it should be noted that the current energy saving policy for the built environment is very dependent on the price of natural gas and electricity paid by end users. Because one third of the energy price paid by households and small companies consists of energy tax, the tax is an important basis for the current energy saving policy for the built environment. Without this tax, efficiency standards will lose their legitimacy and many of the energy saving measures will lose their cost-effectiveness for the end users.

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