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, presently responsible for about 20 % of national CO_2 emissions. The Dutch Ministry of the Interior and Kingdom Relations asked PBL Netherlands Environmental Assessment Agency to assess their policy on reducing the energy requirements of buildings and to advise them on how policy could be made more effective and more efficient.

Because of insufficient data, the effectiveness and efficiency of each individual policy measure could not be assessed. Therefore, we followed a more qualitative approach, looking at the mix of applied policy instruments both theoretically and empirically, using stakeholder surveys and interviews. The policy mix contains financial instruments (energy tax, subsidies), legal instruments (mandatory standards) and communication tools (e.g. labelling, voluntary agreements).

The assessment pointed out that the energy use in the built environment and the related CO_2 emissions are declining. However, it is very likely that the pace is not fast enough to achieve the policy targets for 2020. For new buildings, the energy saving policy works well, but its contribution is limited because the volume of new buildings is low compared to the number of existing buildings. For *non-residential buildings* (offices, shops, schools, health care facilities and hospitals) the existing Environmental Protection Act could be enforced to a greater degree, accompanied with reliable customised energy saving advice. For *privately owned homes*, a more compelling policy is needed. An alternative policy option would be to make the level of existing taxes dependent on the energy label of the individual houses, without increasing the average tax burden (bonus/penalty system). This would stimulate residents to take action and retain their autonomy. Half of the homeowners say that they would agree with governmental regulations to make existing dwellings more energy efficient. For *rented homes*, binding agreements between municipalities and individual landlords may improve the implementation pace of energy saving measures, and landlords could try to eliminate tenant resistance through a more customer-focused approach.

Finally, it should be noted that the energy saving policy for the built environment depends largely on the size of the energy bill. A substantial part of the energy price paid by private households and small companies consists of energy tax. This makes the tax an important basis for the current energy saving policy for the built environment. Without this tax, efficiency standards will lose their legitimacy and many energy saving measures will lose their cost-effectiveness for the end user.

Introduction

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 reduced 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 CO_2 emissions in the Netherlands is emitted by the built environment (Vringer et al., 2014), from the use of fossil fuels, such as natural gas.

SAVING ENERGY WILL NOT BE EASY

The Dutch Government stimulates energy saving measures in the built environment because the use of fossil fuel is not declining fast enough on its own. There are many reasons why the saving rate is not as high as desired; even when energy saving measures bring important benefits, such as paying for themselves within a few years, offering comfort, and owner-occupiers and tenants would save on housing costs. Currently, owner-occupants and tenants are sometimes unable to influence the energy quality of their buildings, they are insufficiently informed, have a lack of knowledge, cannot carry out measures themselves or do not want to be bothered. Also, builders are not inclined to build more energy-efficient buildings, as this may harm their competitive position. Low energy bills in the future are often underestimated by buyers. They do not want to pay a higher price for a more energy-efficient house, even when the total housing costs would be lower (mortgage plus energy bill). To help investors take saving measures and because of the long history of energy saving policy and existing political constraints, in 2011, the Dutch Ministry of the Interior and Kingdom Relations (BZK) implemented a mix of policy instruments, such as an energy tax, various subsidies and energy efficiency standards for new constructions. Off course the Dutch policy is linked with the European EPBD requirements.

THE QUESTION

The Dutch Ministry of the Interior and Kingdom Relations (BZK) asked PBL Netherlands Environmental Assessment Agency to make an impact assessment of the energy saving policy for the built environment. Their goal was to obtain more insight into the effects of the policy and to gain advice on how to make the policy more effective and efficient. The main question for 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 the policy goals being achieved?
- How is the policy shaped?
- How does the policy influence investments decisions?

LIMITATIONS OF THE ASSESSMENT

This policy impact assessment is 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:

- Contributing to the European target of 20 % CO_2 reduction by 2020, by means of energy saving in the built environment.
- Using energy saving as a means to allow people more control over the increase in living expenses.
- Energy saving as a boost for the construction industry.

For this assessment, we focused on the CO_2 emission reduction target and the energy saving goals which are derived from the CO_2 target. The assessment does not address possible effects on housing costs, effects for the construction industry (employment) or the financing of investments. Also, we did not investigate to what extent energy saving measures in the built environment are more or less effective or efficient than energy saving measures in other sectors, such as industry or mobility. 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) – a voluntary agreement signed by over 40 organisations like central, regional and local government, employers and unions, nature conservation and environmental organisations, and other civil-society organisations and financial institutions – is taken into account in the feasibility assessment of the 2020 goals, but this assessment does not address the instruments put forward in that agreement.

Approach

Given the purpose of the policy evaluation, PBL chose to combine a judging and a reflective assessment (see also Teisman 2002). That means that we tried to assess the current efficiency and effectiveness of the policy. In addition, we also attempted to provide more insight into the obstacles that make policy instruments less effective or into why it was impossible to use the intended instrument in practice. With this knowledge, the energy saving policy can be made more effective and efficient.

Figure 1 shows the policy chain in which the effectiveness is the ratio between policy target and policy impact. The efficiency is the ratio between policy deployment and impact. A quantitative policy impact assessment comes with a quantification of the effectiveness and efficiency of the policy instruments, 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).

The effectiveness and efficiency of separate instruments could not be determined, but we could analyse the effectiveness of the whole portfolio of policy instruments. 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 have already been applied for decades and were adjusted or introduced at different 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 assessed portfolio of instruments was not comparable to the current portfolio.

Due to a lack of suitable data on policy effects (see Box 5, Figure 1), PBL chose to do a qualitative assessment, focused on the target range and the functioning of the policy instruments. To answer the research questions, the assessment was divided into three parts:

Contents Keywords Authors

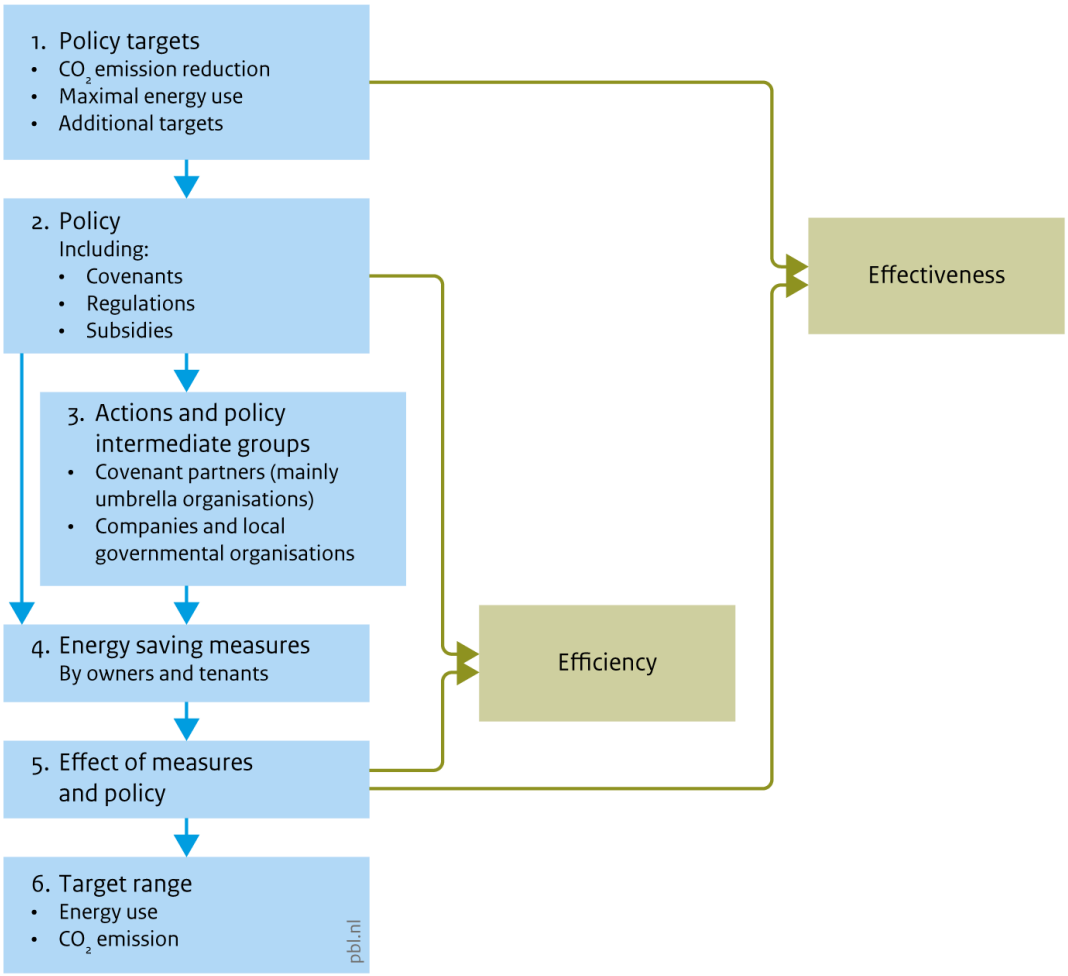

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Figure 1. Policy chain for the Dutch energy saving policy for the built environment.

- An overview of the target range, here 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 most important policy instruments and their interrelationships. For each instrument, the effectiveness and efficiency was established, where possible based on the literature. In addition, a discussion is provided on the interaction between these instruments and other instruments and some other criteria of good governance. Finally, the mix of the instruments is discussed in relation to the target groups – those who have to decide whether or not to take energy saving measures. Here, the assessment focused on the second box in the policy chain in Figure 1.
- 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 the Box 4 and the interactions between the Boxes 2, 3 and 4 of the policy chain, see in Figure 1.

Results

THE TARGET RANGE

CO_2 emissions and energy consumption are expected to decrease, gradually, between 2012 and 2020. However, the intermediate policy target for 2015 has not been achieved. In existing buildings, not enough energy saving measures has been taken. 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 put forward in the Dutch Energy Agreement (SER, 2013) are taken into account. It is expected that CO_2 emissions will be 24.7 Mt by 2020, but the 22.5 Mt target is just within the uncertainty range of the estimate according to ECN et al. (2014).

The national CO_2 emission target has been the basis for the target in the overall covenant *Energy saving in the built environment* (Koepelconvenant, 2012); a maximum energy consumption of 507 PJ in the year 2020. In 2008, energy consumption was 603 PJ. This target also is unlikely to be achieved; the total energy requirement by 2020 is estimated to amount to 521 PJ, about 14 PJ above the 2020 target (ECN et al., 2014). The difference may not seem very large, but considering the effort it will take to save the additional 14 PJ, it is still substantial. Especially given the ambition of the Energy Agreement for sustainable growth to achieve an energy-neutral built environment by 2050 (SER, 2013).

Contents Keywords Authors

The Dutch Government and other actors in the field are partners in the *overall covenant* (Koepelconvenant, 2012). The agreement concerns 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 possible disputes between the covenant partners. The target of the agreement 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 as PV electricity. The agreement's target may be achieved, due to a fast growth in solar PV systems (estimated at 20 PJ for 2020, instead of the initial estimate of 2 PJ as anticipated by the partners) 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 earlier established 617 PJ). The saving on the use of natural gas disappoints. 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 is possibly due to a combination of a rebound effect, lower building quality, poor maintenance of installations, and too optimistic model assumptions (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 targets, contributing to the overall covenant:

- The target of the *Covenant Building Energy-efficient* (Lenteakkoord 2012) was the application of higher energy quality standards for new buildings from 1 January 2015, which is on schedule. The higher standards will lead to a reduction of about 3 PJ by 2020 (Vringer et al., 2014) of the overall reduction target of 96 PJ. The contribution is small because the number of buildings expected to be built between 2015 and 2020 is low, compared to the number of existing buildings.
- Although the energy index of average social housing is declining, the pace 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 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 improve at least 300,000 houses, per year, by two label classes. Up to now, this target has not been achieved. In recent years, about 200,000 houses have been improved in this way. If the trend does not change, by 2020, around 12 PJ will be saved in these types of houses (Vringer et al., 2014). However, because the annual number of houses that have gone up by one label class only is growing, these houses will contribute far more than those that have gone up by 2 or more label classes.

AN OVERVIEW OF THE POLICY

What does energy saving policy for the built environment do?

The government tries to influence the energy saving behaviour of owners and tenants, using policy instruments; see Figure 2 for a schematic representation.

To what extent individuals or companies actually take energy saving measures depends on:

- Their motives. Owners and tenants may have several motives to take or not take energy saving measures. What is important to them? And can energy saving measures contribute to these motives? Motives include issues such as comfort, security, financial considerations, safety and the environment.
- The physical and social context. The physical context consists of building features, such as tenure, amount of living space, construction year, housing type, and things such as financial savings, net income, household size, length of residence and 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.
- Several behavioural processes (see Tiemeijer 2011 and RLI 2014). For example, many people think that the monthly energy costs are negligible and decide not to isolate their dwellings, while in fact average energy costs, for 30 years, have been about 20 % of the price of an average dwelling[1]. Anchoring means that people get an idea of how much something should cost which is based on a given price. Loss aversion refers to people's tendency to strongly prefer avoiding losses to acquiring gains.

Policy instruments may be directed to influence one or more of these factors. In practice, however, in most cases, policy efforts are aimed to affect only the physical context. This is also the case for the energy saving policy for the built environment in the Netherlands. As in most neighbouring countries (OECD 2007), the Dutch Government 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, to improve the energy quality of buildings.

Why a 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). But most of the time, the 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 (a lack of stakeholder support) or other market failures that cannot be addressed by one instrument. In the built environment, the use of a policy mix is justified. There are more market failures and political constrains. Future rev-

1. A very rough calculation: An average Dutch house costs about €250,000 and the monthly energy bill amounts to be €150, neglecting the discount rate and price fluctuations.

Contents Keywords Authors

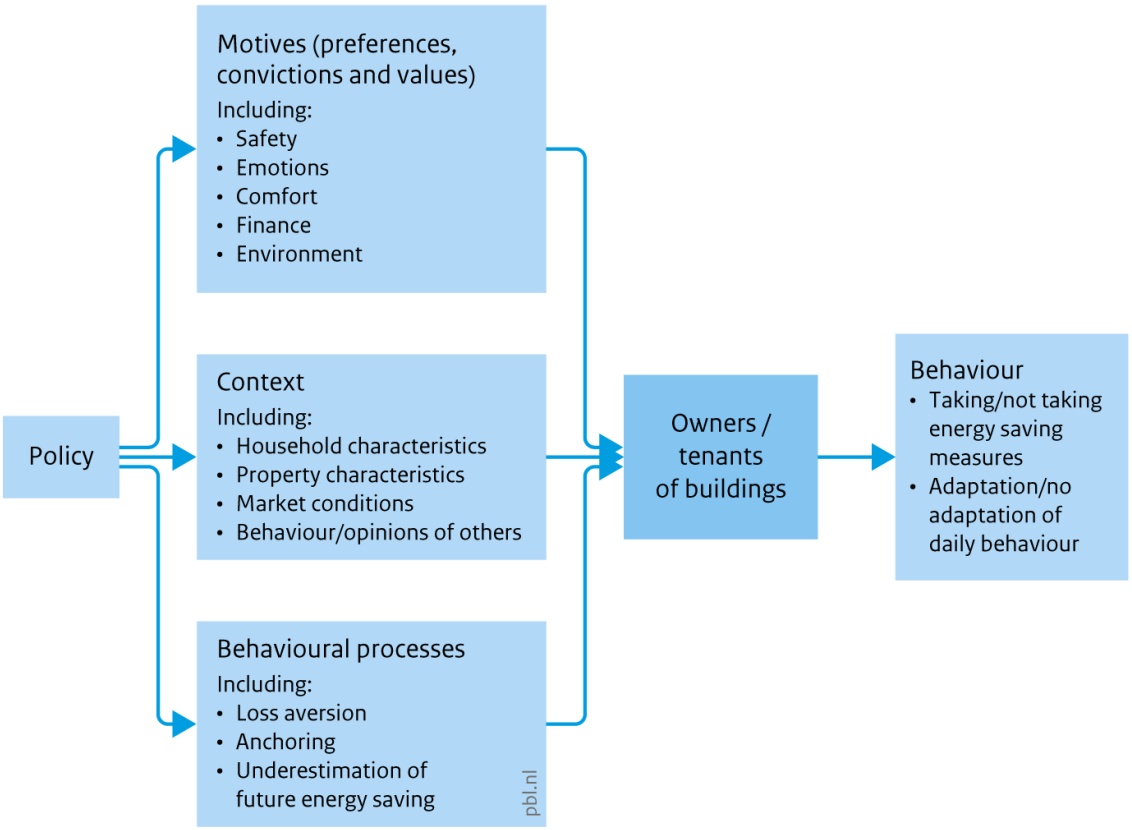

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Figure 2. Behavioural model for tenants and owners.

enues of energy saving measures are undervalued by owners. Prospective buyers underestimate the future cost 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, instruments in 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.

The policy mix

To describe the policy mix, we selected the most important instruments that characterize the policy. 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:[2]

- 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 all subsidies[3]. Now

2. For all instruments a detailed description can be found in Vringer et al. 2014 (in Dutch).

3. There may still be subsidies at the local or regional level available to homeowners.

Contents Keywords Authors

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 (free rider) 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 the split incentive, the national property valuation system was adjusted. With this system, the Dutch Government regulates the maximum rent of social housing[4]. The valuation is based on the property's physical characteristics, energy performance and location, while the valuation of the energetic quality is determined by the energy label.

Legal instruments; legal obligation to take energy saving measures. The most important legal instruments are:

- Higher standards for the energy quality of new buildings (1996). The standards were introduced because there was no demand for more efficient buildings, while the total housing costs could be reduced by a higher energy quality. From 1996 onwards, standards became 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 public administration. In 2012, four covenants were signed or renewed: one overall covenant and three sub-covenants. For a description see the section 'An overview of the target range' above. According to all four covenants, parties may end their participation without direct consequences. According to policy theory, voluntary agreements more easily lead to shared responsibilities and better solutions for 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 missing, and in most cases buyers and sellers agreed to the absence of an energy label, as they expected little benefit from such a label. 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 with a 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 and learning, or 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 have been worked out and builders, housing associations and the government agreed to renovate at least 11,000 existing social houses to turn them into zero energy buildings by 2020. The intention is to expand this amount 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

4. 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 about 700 euros), or can be part of the free-rental market where landlords are free to negotiate any rent level they deem reasonable.

Contents Keywords Authors

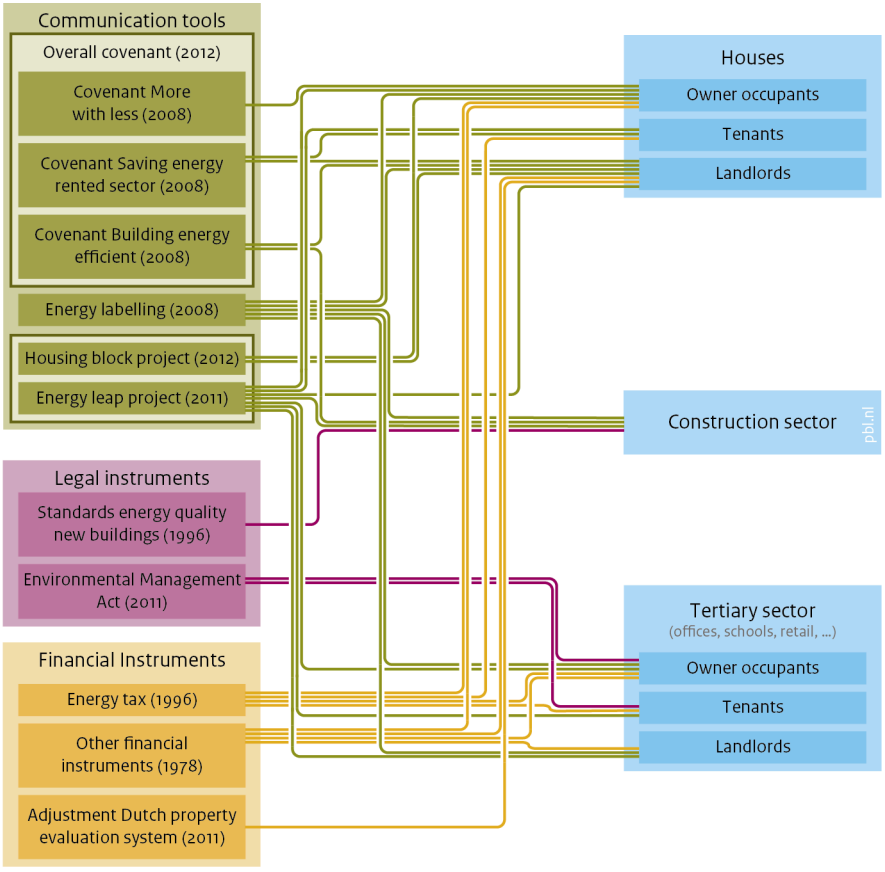

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Figure 3. The relation between policy mix and target groups.

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).

The 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. Noticeable aspects, however, are that communication tools hardly focus on the tertiary sector (here mainly schools, public health, offices, retail) and the legal instruments do not focus directly on the housing sector.

The construction sector

On the one hand, the construction sector has to comply with energy efficiency standards for new buildings, while on the other hand they signed a voluntary agreement also concerning new buildings. 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, innovation pilots and other support.

Housing

The mix of instrument for residential housing tries to:

- shorten the payback time for energy saving measures,
- share the policy problem between government, landlords and suppliers of energy saving measures with voluntary agreements,
- improve the supply of energy saving measures,
- reduce the split incentive for the rental sector,
- make the market more transparent.

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

Owner-occupiers who sell their house are under the obligation to obtain an energy label for their property, which makes 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 owners, they are not a participating party in this agreement. In this covenant, the government and the construction sector agreed to stimulate owners to take multiple energy saving measures simultaneously. Landlords deal with subsidies, fiscal arrangements and the covenant 'saving energy in the rental sector' and the adjusted property valuation system. The new version of the property valuation system reduces the split incentive, and properties

carry a mandatory energy label. To apply energy saving measures, landlords depend on cooperation from their tenants. A vast majority of tenants (70 %) has to agree to measures being implemented even if this increases their rent.

The tertiary sector (schools, health care facilities, offices, shops)
The instrument mix that is focused on the tertiary sector aims 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 pay-back time of less than 5 years.

The financial instruments for owners and tenants are also focused on the tertiary sector. However, compared to households, the energy tax (and hence the energy price) is much lower for companies that use large amounts of energy. 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)[5].

POLICY IN PRACTICE

The central question here is that of how investment decisions are made, including the influence by policy instruments. The analysis is based on a broad view of the main policy instruments (see Vringer et al. 2014), an internet survey among preselected owners and tenants, totalling 2,267 respondents (for a detailed description of the survey, see Vringer et al. 2014 and Veldkamp 2014), a telephone survey among 1,000 building managers (for a detailed description of the survey, see Vringer et al. 2014 and Hoevenagel 2014), and 30 interviews with housing associations, installation companies, builders, and the umbrella organisations involved in the four covenants' negotiations (Hendriksen et al. 2014).

We found that for occupants, landlords and tertiary sector, self-determination is very important. They indicated that they want to be able 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 the surveyed homeowners said that they would agree with governmental regulations to make existing houses more energy efficient. Many owners indicated that they themselves had come up with the idea to take energy saving measures. Landlords saw the covenant '*saving energy in for the rental sector*' as an appreciated long-term target, but ultimately they wanted to decide for themselves which goals would fit their organisation and over which period these goals should be achieved. Companies in the tertiary sector were found to be especially stimulated from within their own organisation, but also the government plays an important stimulating role.

In general, financial return, payback time and financial means are important factors in investment decisions. It is noteworthy that both rented and privately owned houses, in most cases, were made more energy efficient in multiple small steps, instead of one big step. Landlords said they saw tenants as a barrier. For energy saving projects in multiple family buildings more than 70 % of the tenants has to agree with a rise of the rent. Financial considerations were found more often to play a role for tenants than for owners. The tenants reported that landlords who do want to take energy saving measures and credible guarantees that housing costs (including energy) will not rise after energy saving measures have been implemented helps them to agree to the application of such measures. But there was also a large group of tenants for which the energy use of their home was not important at all; they were not familiar with the energy label or its role in the determination of their rent.

It is remarkable that energy taxation has its effect quite unseen. Many people are unaware of the fact that they are paying energy tax. But, taking into account the public debate on this tax, it 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 in their business operation. Homeowners and the tertiary have not. Many do not know the energy label of their building. An energy label does serve a purpose otherwise many people would overestimate the energy quality of their building (see Figure 4). This is also true for homeowners, tenants and building managers of tertiary sector buildings.

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.

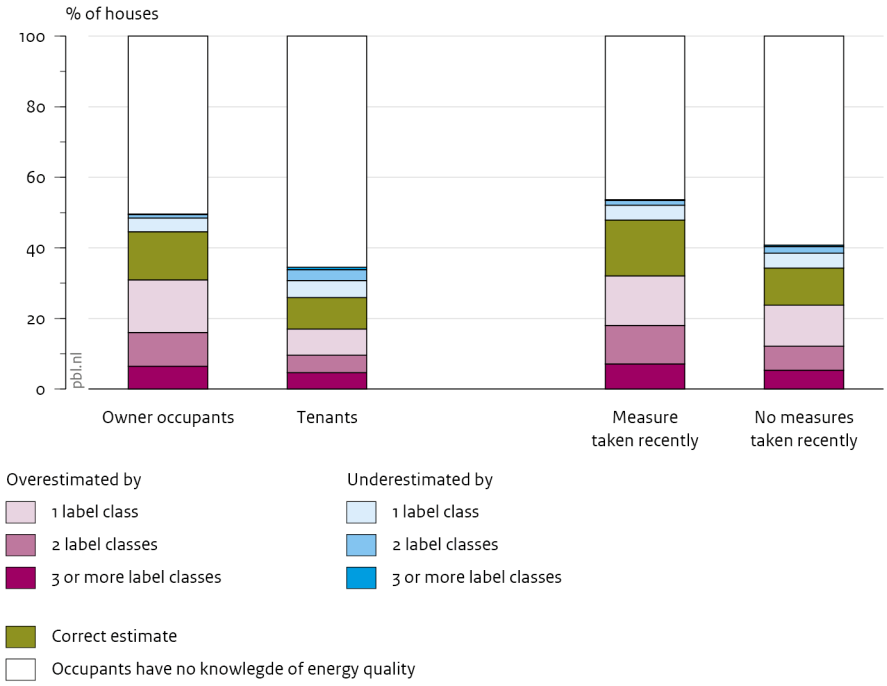
For non-residential buildings, the combination of legal obligation and financial stimulation is insufficient to achieve policy goals in time (see Vringer et al., 2014). A better enforcement of the Environmental Management Act and improvement of the knowledge about energy saving may accelerate the energy saving pace. 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 goals in time. We have no indication that tenants and owners are direct or indirectly stimulated by the covenants. The number of energy saving measures is rising, but it is unclear whether this is partly due to the covenant '*more with less*' (Convenant Meer met Minder 2012). The goal of this agreement, a rise in the annual number of houses that have been improved by two or more energy label classes, has not been achieved. Although individual landlords say they endorse the goal of the covenant on saving energy for the rental sector (Convenant Huursector 2012), but they do not personally feel bound to this covenant.

The adjustment of the property valuation system gives landlords more possibilities to recover the costs of the energy saving measures through rent increases, but in some cases the costs are not fully compensated by a rise of the rent.

5. Examples are efficient lighting, high efficient boilers, motion sensors or heat recovery from ventilation. Mind that the payback time depends on the specific situation.

Contents Keywords Authors



Source: Veldkamp 2014; analysis PBL Netherlands Environmental Assessment Agency

Figure 4. Energy quality overestimation by tenants and owners of buildings.

The innovation and stimulation programmes 'Energy leap project' and 'Housing block project' were focused on improving the energy quality of buildings. The government stimulated both the conventional approach (step by step) and an innovative approach (making a giant leap to an energy neutral building). We consider the exchange of experience between the approaches to be of value.

Conclusions

Before the conclusions two contextual remarks:

- 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 could therefore not be made. With this information we would have been able to make recommendations to optimise the composition of the current set of instruments on a quantitative basis. On the other hand, we were still able to assess the portfolio of policy instruments, with clear results and recommendations. Also please note that if quantitative data about the separate policy instruments would have been be available, less effective instruments cannot simply be replaced by more effective ones.
- This evaluation took place in close collaboration with the Dutch Ministry of the Interior and Kingdom Relations. We found this collaboration to have been very valuable, because the policymakers provided us with a large amount of important information to use in the assessment. It also enabled the assessment to be tailored to the needs of the policymakers. This benefits the objective of the evaluation to provide more insight into the effects of the policy and practical advice on how the policy could be made more effective and efficient. This is not only true for the final product (report), but was also valuable during the evaluation. Such close collaboration only has value if the evaluating party is able to act independently from the policymakers. Fortunately, PBL is an independent government organisation which is not financed directly by the policy department. So, 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.

For new buildings, the construction sector is on track to build more energy efficient buildings. The combination of legal obligation and policy instruments of communication works well. Construction companies have to meet higher energy quality standards, which are legitimised by 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 to the number of existing buildings, the energy saved in this field will be limited to 3 PJ by 2020, and therefore most of the energy has to be saved in existing buildings.

Contents Keywords Authors

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 by not only taking into account 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 companies energy saving is not their main 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 more stringent enforcement of the Environmental Protection Act. But also by improving the awareness among companies. 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 measures would be compulsory.

Energy saving in *privately owned homes* is progressing steadily. Owners are improving their houses in small steps. But the policy instruments are too weak to stimulate owners to take more energy saving measures, on a larger scale. The Energy agreement for sustainable growth provides in the development of more favourable financing conditions and more information. Whether this will be sufficient to accelerate the energy saving pace is debatable. Implementing a more stringent policy is 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 – being able to decide for themselves whether or not taking energy saving measures. Such a tax differentiation could be part of a broad tax reform that the Dutch Government is preparing.

For *rented homes*, 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 that the average energy quality will increase up to 2020. However, at the current pace, the goal of the covenant will not be achieved. For a faster improvement in energy quality of rented houses, 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, will not rise 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 to the price of natural gas and electricity paid by end users. Because one third of the energy price paid by households and small companies determined by 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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