Thomas Hoppe, Sandra Bellekom
and Kris Lulofs

Energy Efficiency in the Dutch Residential Sector: reflections on policy implementation

Introduction

A major objective of Dutch energy programmes and strategies is the reduction in the emission of greenhouse gases, especially CO2. The CO2 reduction target currently being pursued by The Netherlands is 2% annually by 2020 below 1990 levels. Climate change mitigation has been receiving political attention in The Netherlands for a long time, resulting in a particularly close incorporation of energy programmes and measures into a comprehensive, long-term Dutch climate change policy programme, which started in 1998 after the country signed the Kyoto treaty.

In The Netherlands the built environment is responsible for 19% of domestic CO2 emissions (MNC, 2010). Within the built environment, the majority of primary energy consumption and greenhouse gas emissions are from dwellings. The Netherlands has approximately 7.5 million dwellings, housing its population of approximately 16.8 million people (Compendium voor de Leefomgeving, 2012). The CO2 emission impacts of the housing sector are of such a magnitude because many dwellings deliver poor energy performance. Therefore, there is significant scope for energy-efficiency improvements. By energy efficiency improvements we mean technical measures, such as thermal insulation and innovative, high-yield heating and cooling systems, which have the potential to dramatically improve energy efficiency levels of dwellings. If energy efficiency measures are to be applied on a large scale, it is necessary that homeowners be keen to adopt them, despite the fact that they are often unconventional.

Significant factors in the poor energy performance of dwellings are heat loss

Thomas Hoppe, **Sandra Bellekom** and **Kris Lulofs** are at the Twente Centre for Studies in Technology and Sustainable Development, Faculty of Management and Governance, Institute for Innovation and Governance Studies, University of Twente in The Netherlands.
The corresponding author for this article is Thomas Hoppe, t.hoppe@utwente.nl.

through porous walls, single-glazed windows and poorly-insulated roofs and floors. During the first decade of this century, energy prices doubled and electricity prices increased by 20%. (In The Netherlands gas is the main primary energy carrier.) Faced with increasing energy prices, tenants encounter economic hardship through higher living costs (Min BZK, 2011); there have already been cases of house evictions (Agentschap NL, 2012). Improving the energy performance of dwellings is therefore very important as an effective means to reduce fuel poverty (Healy and Clinch, 2004). Improving the energy performance of dwellings is also thought to result in an overall improvement in health (Milne and Boardman, 2000). Furthermore, it helps the Dutch government to achieve its climate policy goals. The Netherlands is committed to contributing to the European Union's climate policy target of 20% CO_2 reduction by 2020 compared to the 1990 level (Min BZK, 2011).

In this article we assess the role played by government policy in facilitating the transition towards sustainable energy consumption in dwellings. In addition, we seek to generate lessons for the New Zealand government regarding opportunities and challenges for energy efficiency improvements in dwellings. The article is structured as follows. First we explain what policy arrangements have been put in place in the period 2005–10, and describe the programmes aimed at both old and new residential dwellings. In the next section we address the implementation of these programmes and present arguments and reflections on the impact of their implementation. Following this, we reflect on the main experiences. We conclude by specifying some policy lessons from this Dutch case study that we consider relevant to the New Zealand government.

Policy programmes on energy efficiency in residential areas

Due to the influence of the Brundtland commission's report, *Our Common Future* (World Commission on Environment and Development, 1987), the issue of anthropogenic greenhouse emissions gained momentum in Dutch politics in the late 1980s. More attention was drawn to this issue in 1992 at the Rio de Janeiro Earth Summit, and in 1997 at Kyoto (De Jong et al., 2005). As a consequence, a formal climate mitigation programme was introduced in The Netherlands to achieve the national emission target set at Kyoto: 6% CO_2 emission reduction by 2010 as compared to the 1990 level (Min VROM, 1999).

Besides encouraging local stakeholders to adopt energy efficiency measures, the programme also focuses on the development and demonstration of energy innovations in residential dwellings.

Dutch climate policy is differentiated into economic sectoral packages, one of which concerns the 'built environment', meaning residential dwellings and utility buildings. In 2002 it was estimated that this sector would be responsible for emission of 57 megatons of CO_2 per annum by 2010. The goal for CO_2 reduction in the 'built environment' was 3.6 megatons per annum (Min VROM, 1999). This would lead to a 30% reduction by 2010 as compared to the 1990 level (SenterNovem, 2002).

In this article we address only residential dwellings. The programme in this sector has a reduction goal of 2 megatons CO_2 per annum (SenterNovem, 2002, p.5), and involves a comprehensive policy mix. Measures to reduce CO_2 emissions focus on different solutions, including change in energy consumption behavior, energy efficiency improvements, and use of renewable energy sources (SenterNovem, 2002). Given the character of the programme strategy and policy instruments, we believe that a further distinction in terms of government approach can be made between programmes for (a) construction of new residential dwellings, and (b) old residential dwellings. We address these below.

During the 1998–2010 period the Ministry of Housing was made responsible for implementation of the energy and climate policy programmes for residential dwellings. Managerial execution lay with the national energy agency SenterNovem, and operational execution at the local level with the municipalities (Hoppe, 2009). The main target groups of the programme are housing associations, homeowners, private commissioners (future home-owners) and project developers (SenterNovem, 2002). Besides encouraging local stakeholders to adopt energy efficiency measures, the programme also focuses on the development and demonstration of energy innovations in residential dwellings. Goals are to be achieved at household level, with homeowners adopting energy efficiency technology in household appliances. The basic presumption implies that they will make the investments with the expectation of a return due to lower energy costs in the long run.

Programmes targeting energy efficiency in new dwellings

The design and construction of new dwellings offers superior opportunities for sustainable energy consumption compared to the renovation of existing dwellings. A major advantage is that significant potential obstacles to high energy performance dwellings (which may be physical, social, institutional and infrastructural) are either minimal or absent. This permits a wider range of energy-efficient and renewable energy technologies and appliances to be installed, such as solar thermal, solar PV (photovoltaic) and even geothermal systems.

The main target group is project developers and future house-owners who are having new dwellings built. The policy programme mainly aims at improving

the energy efficiency performance of new dwellings by means of: minimum energy efficiency building standards; and subsidy schemes to encourage the adoption and diffusion of innovations (see Table 1). Beside these instruments there are several others, such as multilateral agreements and information campaigns. Here we address only the main instruments.

Programmes targeting energy efficiency in old dwellings

The most difficult challenge in the climate mitigation programme is to encourage the adoption of energy efficient technologies, measures and appliances throughout the existing (old) housing stock. This is because target groups are currently expected to invest in energy efficiency voluntarily. For these programmes the target group includes house-owners and small-scale landlords (who may rent living space to students in cities, for example), and housing corporations.

House-owners are most likely to be influenced to adopt energy efficiency measures at special times in a 'dwelling's lifetime' (SenterNovem, 2004). These 'natural moments' should provide significant windows of opportunity for adoption of energy-efficient measures. Renovation is such an occasion (Agentschap NL, 2012). Underlying the 'natural moments' logic is that house-owners and tenants have predominantly economic motives and expectations related to improved comfort. First, since they are already making an investment and there is some room for manoeuvre, it is easier for house-owners also to apply energy efficiency measures at such a time (even though these are seldom the main reason for action). Secondly, introducing energy efficiency measures at the same time as other modifications minimises the fuss and disruption involved for both house-owners and tenants. Beyond these 'natural moments', however, house-owners are quite difficult to target. In The Netherlands, renovation and maintenance activities in existing dwellings mostly do not require legal approval and permits. Local governments thus have little influence on such activities.

By contrast, housing corporations are relatively easy to target by means of policy instruments, since they own and manage large stocks of dwellings (on average 6,206 units per housing corporation). In The Netherlands, 389 housing corporations own 31.3% of the total housing stock, i.e. 2.4 million dwellings (CFV, 2012). Housing corporations are former semi-public organisations which manage dwellings with the public objective of delivering quality housing to citizens who cannot afford or do not have access to credit to buy houses themselves. The housing corporations were privatised in 1995 (Koffijberg, 2005) and ever since it has been the aim of the national government to achieve desirable societal goals in urban residential areas with their help. These policies mostly take the form of financial schemes, which are closely monitored and are accompanied by financial/economic and social performance indicators for the housing corporations.

Table 1: Main policy instruments for energy efficiency in new dwellings.

Name of instrument	Type of instrument	Description	Assessment on the instrument's impact on energy performance (See section 3)
Energy Performance Standard (EPN)	Legal	Legal minimum standard reflecting the energy performance of a building to be constructed. Energy performance is expressed in the energy performance coefficient. The standard becomes periodically stricter. Meeting the energy performance standard is an obligation for anyone who builds a new dwelling.	Modest
Innovation subsidies	Economic	A subsidy scheme that supports local initiatives for demonstrating energy innovations that cannot yet compete under market conditions.	Modest

Table 2: Main policy instruments for energy efficiency in existing dwellings.

Name of instrument	Type of instrument	Description	Assessment of the instrument's impact on energy performance (see Section 3)
Energy Label	Voluntary, communicative	When selling one's dwelling one is expected to voluntarily hand over a certificate expressing the dwellings energy performance as a qualitative classification, where A++ expresses the best energy performance and F the worst. The energy label follows the implementation of the EU Directive EPBD 2002/91/EG.	Low
Rollout of Smart Meters	Physical, communicative	The Netherlands implements the EU Directive 2006/32/EG on energy efficiency, which also implies the replacement of old metering systems with intelligent ones. The EU aspired to have installation in 80% of households throughout the EU member states by 2020. Smart metering is assumed to increase the end-users' awareness of energy consumption and provide daily information on end-consumer electricity consumption to utilities.	Low

The main policy instruments included in the programme targeting old dwellings are the energy label and the roll-out of smart meters (see Table 2). Not surprisingly, a lot of attention and budget is also devoted to information campaigns and subsidies. The programme targeting old dwellings has no legal standards.

Implementation of the Dutch policy programmes

Tables 1 and 2 present a qualitative assessment of the impacts of the policy instruments (column four). We have indicated whether the impact of the instrument was 'high', 'modest' or 'low'. We used these qualitative labels in the absence of straightforward quantitative performance data on assessment criteria. Performance data are either not monitored or are not disclosed to the public by the national government. This is also mentioned in Dutch climate mitigation programme evaluations (e.g., see KplusV, 2010). Below are our reflections that underlie arguments for our assessment of the two policy programmes.

Implementation of programmes targeting energy efficiency in new dwellings

Energy performance standard

The mandatory building energy efficiency standard (EPN) was adequately implemented, and was systematically and progressively tightened from 1995 onwards. The methodology of the standard is disputed, however. It differs substantially from other building energy performance standards elsewhere in Europe. Most European countries apply a standard which measures the energy consumption of a dwelling (in kilowatt hours) per square metre per annum. This is arguably a transparent method and is easy to measure. By contrast, the Dutch standard features a complex calculation method, which is considered (by adherents of innovative integrated housing designs, such as passive housing (discussed below)) to be non-transparent and to discriminate among energy systems and technologies with applications in buildings. Moreover, it is perceived as largely neglecting the impact of insulation on reducing energy demand. Furthermore, the building energy performance standard has been criticised by different experts in the field (such as project developers, passive housing experts and architects) as unambitious, as it provides little impetus for integrated system design of dwellings in order to optimise the energy efficiency standards (Faber and Hoppe, 2013). In sum, the legal requirement forces the target group members to meet a minimum standard, but it does not encourage them to build dwellings with energy performance that goes far beyond it, nor to adopt the most innovative energy efficiency technologies.

Although several innovative projects were successfully carried out, the programme failed to achieve its main objective of supporting the transition towards a sustainable energy economy.

In addition, current legislation prevents local authorities (which have the authority to enforce implementation of this legal instrument) from enforcing more ambitious local building standards. Moreover, ensuring compliance with the EPN standard is problematic, according to a 2007 survey in which EPN calculations turned out to be in error in 25% of cases, while the design was only constructed correctly in 50% of cases. Furthermore, monitoring policy enforcement is poor, as insufficient enforcement staff are employed by the local governments. Finally, construction safety and fire safety issues are prioritised over energy performance (Nieman, 2007; Min BZK, 2011).

Innovation subsidies

Innovation subsidies were implemented to encourage the adoption of innovations in dwellings (and utility buildings), and to 'support the transition to a sustainable economy'. The subsidies were part of a broader programme on energy research in the built environment ('Energie Onderzoek Subsidie Gebouwde Omgeving'), which started in 2005. Research focused on four areas: solar thermal systems, heat pumps, solar PV systems, and integrated systems for housing design. The subsidy scheme set strict criteria for the applicants – mainly collaborations between the market (project developers, material suppliers, construction companies, consultancies, housing companies) and public partners (universities, research institutes, local governments). These criteria were also applied to the innovation, and the pay-back period. The subsidy scheme involved co-financing the investments in energy efficiency materials and construction. It triggered several innovative projects, such as 'climate neutral dwellings' and the construction of passive housing design.

'Passive housing design' is an integrative concept which combines several measures to improve energy efficiency in dwellings: high-quality insulation, mechanic ventilation with heat recapture, and orientation towards the sun; sometimes, solar heating and solar PV systems are installed in addition. Passive housing will become the minimum energy performance standard for new dwellings in the EU member states from 2020. A successful demonstration project was the construction and retrofitting of 246 dwellings in the city of Roosendaal during 2008–11. This was the first time that the passive housing standard was applied on a large scale in The Netherlands. Previously, large-scale application of this innovation had been confined to the Nordic and Germanic countries. In total, 58 demonstration projects and experiments were carried out following the 'integrated system' programme tender (SenterNovem, 2007); and 15 demonstration projects (with at least 50 dwellings on-site) were funded following the 'climate neutral dwellings' programme tender.

Although several innovative projects were successfully carried out, the programme failed to achieve its main

objective of supporting the transition towards a sustainable energy economy. In common with many other Dutch innovation programmes, the focus in the demonstration projects was too much on technology and the supply side of the market. For that reason, the programme failed to consider the human and organisational factors and social acceptance that are necessary to trigger the adoption and diffusion of energy efficient and sustainability-oriented innovations. Moreover, it focused too little on the diffusion of best practices and lessons learnt. This was in large part due to the programme design, which placed the emphasis on technological measures which counted as 'proven technology', with fixed, short pay-back periods (to safeguard 'short-term feasibility of business cases'). Thereby, the programme omitted more radical, but financially risky, innovations and practices (Rotmans, 2011). Furthermore, some of the experiments and demonstration projects could not be carried out properly or were blocked altogether. This was due to a combination of factors: lack of regulative room (for organising 'policy experiments', thereby giving geographic and temporal exemption from existing regulations); limited interaction between stakeholders; and a lack of alignment in visions and strategic agenda-setting (Faber and Hoppe, 2013).

Implementation of programmes targeting energy efficiency in old dwellings

Energy label

The energy label was designed to support and speed up the monetary appreciation of energy performance in buildings. Homeowners are required to hand over energy labels indicating the energy performance of their dwellings when their dwelling is offered for sale. The energy label (see Table 2) was introduced in The Netherlands in January 2008, following the Energy Performance Building Directive (Directive 2002/91/EC). Among EU member states, The Netherlands was the last country to introduce the label (the other member states having done so in 2006). In the years prior to 2008, the right-wing Dutch government continually postponed implementation of the directive for fear of high administrative costs (Hoppe, 2009).

When the energy label was finally introduced, it encountered significant implementation obstacles from the main target group, homeowners, organised by their representative association 'Own House' ('Eigen Huis'). This influential association publicly dismissed the reliability of the assessment method underpinning the energy label, and actively discouraged adoption by its members (Vereniging Eigen Huis, 2008). The energy label was problematic in other respects, too. Given its voluntary nature, the option was open for house sellers and buyers to omit any references to the energy label from the sale/purchase contracts. The seller is only obliged to provide an energy label to a potential buyer at the latter's request, and not at the request of any public authority. Hence, despite its 'obligatory nature', it is a voluntary instrument. Once it was known that energy labels were not really obligatory, energy labelling was dismissed in most housing transactions because house buyers ('on whom the costs would be eventually passed by sellers') were not willing to pay the amount of money involved to have an energy label drawn up by an engineer (the lowest price being €177). By 2012, only 2 million dwellings (of a total of 7 million) had acquired energy labels. Of those, only 13% were rewarded a 'green label', indicating the more advanced energy performance: labels 'A++, A+, A and B' (PBL, 2012).

In sum, the energy label might have been a potentially effective instrument, but it was compromised by its voluntary nature. In addition, slow progress is also explained by indirect implementation problems, in particular poor communication and coordination between central and local governments on support programmes (KplusV, 2010). Nonetheless, labelling also had a few positive effects: for instance, there appears to be a positive correlation with the financial-economic appreciation of dwellings (Brounen and Kok, 2011). Adoption of energy labels by housing companies was modest, even though they were legally obligated in 2008 to have energy labels applied to their housing stock. As a result, half of the social housing stock (1.2 million dwellings) had been labelled by 2011 (Min BZK, 2011).

[The end users] did not like the idea that an energy company would have access to their private 'real-time' energy consumption data, and requested the responsible minister to investigate grounds of unlawful intrusion of privacy.

Roll-out of smart meters

Smart meters record the consumption of electric energy in intervals of an hour or less, and communicate that information at least daily back to the utility for monitoring and billing purposes. Smart meters also provide end-users with feedback on their energy consumption, which might serve as an incentive to reduce domestic energy consumption. As in other EU member states, smart meters were planned for installation in all domestic dwellings in The Netherlands (against a penalty of up to six months in jail or a fine of up to €17,000 for refusing installation). However, the roll-out of smart meters was not successful.

This failure had its origin in the defective design of the policy instrument. To start with, the policy-making process placed great emphasis on the technical and commercial aspects, but neglected end-user aspects. The policy-making arena consisted of energy companies, producers of smart meters and national government; dwelling occupants and their representative bodies were not invited

to participate. By shutting out the end-users, the policy makers failed to identify risks that would occur when the roll-out was introduced. By 2008, when the smart meter roll-out was in full swing, it turned out that many dwelling occupants were opposed to the installation of smart meters in their dwellings. They did not like the idea that an energy company would have access to their private 'real-time' energy consumption data, and requested the responsible minister to investigate grounds of unlawful intrusion of privacy. In June 2008 a committee confirmed this claim. This meant that dwelling occupants could henceforth lawfully refuse smart meter installations: this created a precedent which effectively blocked any further smart meter roll-out.

In sum, the Dutch experience shows that introducing smart metering is liable to failure when the technical and commercial aspects are considered to be more important than the interests of the end-users (Hoenkamp et al., 2011). Another implication is that sustainable energy transitions may require legal changes more broadly, beyond energy programmes, to generate new and coherent legal frameworks. In this case, simultaneous changes in privacy legislation would have prevented end-users appealing and winning.

Lessons

Central government had the programmes evaluated in 2010 (Min BZK, 2011). The Ministry of Internal Affairs and Neighborhoods concluded that, 'although progress had been made, a "breakthrough" in terms of meeting pre-set goals, had not been achieved' (Min BZK, 2011, p.4). In other words, progress had not been substantial. As we have shown, this was largely the result of a combination of factors: too ambitious goal-setting (very high energy efficiency targets, not matched by suitable policy instruments, as in the case of the energy label and smart metering); the failure to (adequately) involve key target groups in policy-making processes, and an overemphasis on technology and neglect of 'human' and organisational factors in innovation policies; the predominance of 'soft' policy instruments and the lack of legislation; innovation programmes which favour relatively un-innovative technologies and practices; target group members' mistrust of the energy labels, energy performance standards and their methodologies; and few incentives to encourage target group members to start radical innovative demonstration projects beyond the state-of-the-art of technology. These policy design and policy implementation obstacles are consistent with findings of other academics regarding the failure of 'green' transitions in the built environment (e.g., Rohracher, 2001; Ornetzeder and Rohracher, 2006; Van Bueren, 2009).

Policy advice to the New Zealand government

Based on the Dutch lessons, we would advise the New Zealand government wishing to adopt similar policy instruments to:

- develop transparent and simple energy performance methodologies for energy standards and labels to make them adaptive to change;
- allow for temporal and geographical legal exemptions from the energy performance standard and label regulations in order to permit innovative experiments and demonstration projects;
- focus not only on technology and the rapid commercialisation of innovative technologies and practices;
- pay sufficient attention to 'human' and organisational factors, especially social acceptance;
- be sure to set innovation subsidy criteria which permit innovative technologies that are not yet (market) proven and do not focus only on financial/economic feasibility (e.g., short-term pay-back periods);
- involve end-users (dwelling occupants) early in policy-making processes, in order to avoid not identifying barriers that might threaten policy effectiveness once the policy programme is implemented;
- ensure that energy labels are really obligatory, not just a voluntary instrument disguised as a mandatory instrument (check legal frameworks for potential grounds for exemption).

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