

# **Chances for the upscaling of living-cost neutral renovations in the Netherlands**

**Erwin Mlecnik**

Management in the Built Environment, Faculty of Architecture and the Built Environment, TU Delft, P.O. Box 5043, 2600 GA Delft, The Netherlands

e.mlecnik(at)tudelft.nl

**Abstract.** Many multi-owned condominiums need an energy renovation, but in practice the number of such renovations is low. Dutch policy emphasizes the need to search for cost-neutral renovation solutions. This study therefore examined how the number of living-cost neutral renovations of buildings owned by assemblies of homeowners in the Netherlands can be increased by means of an integrated unburdening offer that includes energy performance guarantees and supply chain integration. The study uses scientific literature, project experiences and in-depth interviews with experts to examine how policy, demand and supply currently play a role in the upscaling of living-cost neutral renovations. The study finds that customized guidance is needed for condominium associations to steer their maintenance decision processes towards deep renovations. Also chances are detected to link living cost neutrality with energy neutrality, while developing an integrated supply chain that takes into account full process guidance including the provision of performance guarantees. This is now already successfully implemented in a new non-profit service desk.

## **1. Introduction**

Condominiums are the most common residential building type in the EU: 42% of residential buildings in the EU are apartments, mostly in major cities. Similar to other residences, a large portion of the existing condominium stock was built before the introduction of thermal insulation standards, needs renovation in the near future, and gets renovated only at a slow pace. In The Netherlands about 60% of the homes owned by condominium associations (CAs) was even built before the war (CBS, 2016).

Compared to the renovation of single-family owned dwellings or condominiums owned by a housing association, renovations of condominiums with multiple owners are hindered by slow adoption processes, as the investment decisions are made by owners represented in CAs, who usually gather only once a year. The renovation processes are slowed down by the needed guidance of inhabitants and complex decision-making is the rule (Paradies et al., 2017). Furthermore, there are concerns that the renovations might lead to higher total living costs (Schilder & van der Staak, 2020). On the other hand there might also be substantial reductions in energy costs, which could possibly reduce total living costs. Also, the volume and budget of condominium energy renovations make it interesting for suppliers to offer services for this target group. It thus makes sense to look into the opportunities of developing a construction supply chain offer for living-cost neutral condominium renovations.

## 2. Research approach

### 2.1. Context

This paper is an elaboration of the results of the MMIP-IEBB project 7.5 “Woonlasten-neutrale renovatie (WNR)”, which were previously presented in Dutch (Mlecnik, 2021). The project aimed for a practice consortium composed of Servicebureau WNR (a non-profit organization established during the project), DNA in de Bouw (an association of innovative contractors and service providers) and knowledge institutes KERN and TU Delft to stimulate supply chain innovation to develop the market penetration of energy renovation for CAs. The project emphasized the empowering of the enthusiasm of building owners and the upscaling of small-scale renovations with SME's by means of open innovation, particularly to develop an offer for CAs.

### 2.2. Research question and approach

The research tried to answer the question: How can living-cost neutral renovations of buildings owned by condominium associations be upscaled?

The research investigated this question from three viewpoints: policy, demand and supply. It thus aimed to find synergies while creating recommendations for policy, for seducing homeowners to invest in their living unit and for companies to invest in innovation and supply chain integration. As a practical case, the business model of WNR was assessed in view of upscaling their ongoing activities to support CAs.

### 2.3. Research method

The research structurally followed subsequent steps to come to a merger of interests (van Hal, 2014). First, the interests of stakeholders and solution providers for CAs were inventoried. Second, measures were formulated taking into account these and future interests. Third, innovative actions and experiences were searched for to make these measures possible.

This research was supported by mixing literature study, desk research of European projects and results from semi-structured in-depth interviews developed in the IEA EBC Annex 75 “Cost-effective Building Renovation at District Level Combining Energy Efficiency and Renewables” (Mlecnik and Hidalgo-Betanzos, 2022). The interviewees (see Table 1) were a mix of Dutch frontrunners which were considered to be experienced with the concept of living-cost neutral home renovations. The interviews took about 1,5 hours per person, were recorded and were analyzed with an Annex 75 analysis spreadsheet to obtain a PESTLE/SWOT analysis. The results were coded according to the topics policy, business model and stakeholder dialogue to compare relevant data.

Code	Date	Type of organization	Position interviewee
I-1	03-11-2020	Supplier living-cost neutral renovation	Director
I-2	09-02-2021	Energy cooperative	President
I-3	22-02-2021	Province	Project leader local initiatives
I-4	16-12-2020	Municipality	Consultant energy
I-5	26-03-2021	Supplier integrated home renovation	Director
I-6	12-04-2021	Municipality	Strategy consultant policy
I-7	19-04-2021	Manager revolving fund	Consultant strategy and development

Table 1: Interviews carried out with Dutch stakeholders (Mlecnik, 2021; Mlecnik & Hidalgo-Betanzos, 2022; Konstantinou & Haase, 2022)

## 3. Research results

In the following sub sections the main results per viewpoint are discussed: policy, demand and supply.

### 3.1. Policy

The European Union (2018) commits itself to develop a carbon-free built environment by 2050 and gives priority to energy efficiency and to the use of renewable energies. The European Commission

(2019) wants to halve the energy use in 2050 compared to 2005, hereby stimulating a higher renovation rate and more deep renovations. This resulted in the Renovation Wave strategy (European Commission, 2020) as core part of the European Green Deal, that wants to build up an industrialized renovation sector and stimulate financial actors to finance renovations. The core policy ambition – which will also need to be translated to the Netherlands – is to transform existing buildings into nearly zero-energy buildings with a healthy indoor climate, to reach an annual renovation rate of 3%, to improve equal access to finance taking into account the affordability and the financial capacities of vulnerable households, and to gradually phase out the buildings with the worst energy performance labels. This also implies a strengthening of energy renovation loans, energy performance contracts, reducing investment risks and providing integrated home renovation services including smart financing (European Union, 2018). Within this context specific attention has to be paid to condominiums, taking into account supply chain integration, coupling of demand and supply, and smart processes that take into account the energy performance certification, building audits, renovation plans, ownership structures and possible supporting mechanisms (Changeworks et al., 2020).

While the upscaling of living-cost neutral renovations fits well in European policy and the Netherlands has the same goal for a climate neutral built environment in 2050, national and regional/local strategies seem to be far less developed. In 2019 in the Netherlands, about 9% of all greenhouse gas emissions or about 70% of the total emissions in the built environment were still originating from the residences (PBL, 2020; Steenbekkers et al., 2021). Meanwhile the development of energy renovations is too slow (WRR, 2016; SER, 2018; PBL, 2020) and suffering from a lack of deep renovations (Filippidou et al., 2019). While the current government emphasizes the need for one million new homes, about 7 million homes and 1 million buildings are still poorly insulated and heated with gas (Klimaatberaad, 2019). According to the Dutch climate law 1,5 million homes need to be handled by 2030 (Steenbekkers et al., 2021) and 200.000 homes should be able to disconnect from the gas supply (TKI Urban Energy, 2019). To improve the situation Multi-annual Mission driven Innovation Programmes (MMIP) followed starting programmes such as the Energy Leap/ “Energiesprong” (Stutvoet, 2018), the Renovation Accelerator (Renovatieversneller, 2020) for rented dwellings, the programme Gas-free neighborhoods (Rijksoverheid et al., 2020) and the Human Capital Agenda (Visser et al., 2019). The MMIP’s support the development of integrated renovation concepts, industrialization and digitization of renovation processes and the central positioning of building owners and users (TKI Urban Energy, 2019; TNO, 2019).

The Dutch Climate Council emphasizes the need for balancing monthly payments for a renovation loan with the advantages on the energy bill, possibly completed with customized support (Klimaatberaad, 2019). Particularly for social rented dwellings the average real saving on the energy costs should not be lower than the rise of the rent or service costs after renovation (Aedes & Woonbond, 2018). Loans of the National Heat Fund were also made available for CAs. This allows to obtain maximum €50.000 for a “Highly Energy-Efficient” renovation package and €65.000 for a “Zero-on-the-meter” package with a payback of 10 to 30 years (de Koning & Paradies in: van der Schoor, 2020).

Considering the research topic and according to the interviewees, there are still many policies that could be strengthened, for example related to taxation, guarantees (I-1; I-3), innovation (I-3), hereditary tenure or change of ownership (I-3; I-5; I-7), equal access to financing (I-5; I-6; I-7) and process guidance (I-1; I-5; I-6), particularly addressing integrated home renovation services (I-5) and combinations of measures (I-2).

Local and regional authorities also could play an important role as in the Dutch context they are responsible for setting up plans for gas-free districts and regional energy strategies, which in turn might be coupled with renovation strategies. Many municipalities also already offer an energy advice desk, and experts recommend these should advance towards better reaching out to districts (I-2; I-4; I-6). Particularly there is a need to develop towards process guidance for groups of homeowners (I-1; I-2; I-5), local renovation hubs (SaveTheHomes, 2021), integrated renovation offers including unburdening of financing and guarantees (I-6; I-7) and digital communication (I-2; I-6).

District approaches seem to be complex though, requiring intensive stakeholder dialogue and considerable means and competencies. Nowadays they seem to be too focused on heat grid development (I-3; I-4; I-6), even without requirements regarding supply temperature or use of renewable energy sources (I-6) or transparency of connection costs (I-1; I-3; I-5).

The Dutch government (BZK, 2020) asked the municipalities to look beyond the development of living-cost neutral approaches and to improve also the indoor comfort, the development of real estate value, the living and financial conditions of the inhabitants, and the livability of the districts. The research confirmed that instead of a geographical approach, it might be more important to facilitate groups of inhabitants or collective units (I-1; I-2; I-3; I-5), particularly bottom-up initiatives (I-3; I-5; I-6), while also engaging energy communities (I-6) or societal ESCo's (I-7) and supporting group buying initiatives (I-2).

Overall, the literature and empirical research found that currently Dutch national policy still doesn't give or support a clear direction and adequate communication to target deep renovations including energy efficiency and renewable energy systems. In this context, policy development should target CAs by providing appropriate guidance processes for achieving integrated renovations.

### *3.2. Demand*

Data show that the market for renovating buildings owned by CAs deserves attention. In 2015 in the Netherlands there were about 144.000 CAs related to about 1,2 million homes, a majority of which was privately owned (CBS, 2016). About 45% of the CAs can be found in Dutch cities (Paradies et al., 2017), with 30 to 50% concentrations within the four major cities (Ringelberg, 2019). About 75% of all CAs can be found in the provinces of Utrecht, South Holland and North Holland (CBS, 2016). 40% of the CA owned buildings consists of maximum 2 living units, 40% has 3 to 10 living units and the rest has more than 10 living units (Paradies et al., 2017). Only about one third of the CAs is governed by one of the 550 management offices (communication Bouwkennis). The associated real estate values are relatively low and the household incomes relatively average (CBS, 2016).

This bring us to the question how to target this sector, this means how to seduce CAs to engage in renovation. There have been numerous studies about what drives or hinders individual homeowners in their renovation decision-making (Lindenberg & Steg, 2007; Balcombe et al. 2013; Wilson et al., 2015; Ebrahimigharehbaghi et al., 2019; Greer et al., 2020). More promising results could be achieved when the decision processes can be socially steered and influenced by influential people in the surroundings (Schultz et al., 2007; Steg et al., 2015; Langley et al., 2020). Important success factors could be that the owners already detected a renovation need (Schalkwijk, 2018). Other promising success factors can be that the whole customer renovation journey is guided (Ebrahimigharehbaghi et al., 2019; Mlecnik et al., 2019) and that guides who are trusted (Vringer et al., 2014) offer services beyond (neutral) information provision (Pettifor et al., 2015) and audits (Cattaneo, 2019). And of course providing personalized access to financing plays a crucial role (Wilson et al., 2015; Schorel & Opstelten, 2018; Bos et al., 2020). For owners also the rise of the real estate value after renovation can play a role (Brounen & Kok, 2011; Aydin & Kok, 2020; CPB, 2020; Steenbekkers et al., 2021). For tenants the financial profit of renewable energy production (Steenbekkers et al., 2021) might be an argument. For building renovations decided by CAs the business case should be attractive and related to the multi-annual maintenance plan and the collective finances (Paradies et al., 2017).

Literature shows that there are important legal and administrative hindrances when targeting multi-owned buildings. CAs can still be dormant or non-existent (CBS, 2016). Ownership legislation could hinder reaching out to CAs (Weatherall et al., 2018). For many CAs changing or establishing a deed of division is still too cumbersome (Siewers & Luijk-Van Veldhuizen, 2018). A minimum reserve fund should be available, which is currently no obligation (Ringelberg, 2019).

Interviewees recognize these observations and believe that a maximum exploitation of opportunities can lead to a larger acceptance of investing in more renovation measures beyond maintenance (I-1; I-5; I-7). CA administrators and managers are perceived as a primary influential target group that could also be better trained on administrative, maintenance and sustainable renovation matters (I-1). All

interviewees found creative ways to communicate with and motivate homeowners, usually focusing on messages of increased comfort (I-1; I-4; I-5), energy cost savings (I-1; I-2; I-4) and smooth processes with energy performance guarantees after renovation (I-1; I-5). The needed coaching of energy renovations is emphasized (I-1; I-2; I-5; I-6), which needs the development of a sound business case (I-1; I-3), a collective approach to facilitate decision processes (I-1; I-2; I-5), and equal access for vulnerable households to financing (I-2; I-4; I-7).

Overall the research found that to upscale living-cost neutral renovations there is a need for customized CA support to arrange the whole renovation journey, including solving administrative and legal hurdles, detailed advice and training for the CA. Customized design, process management and financing solutions should be developed and coupled to performance guarantees and personal access to finance. Policy could support identification of CAs whose buildings are in need of renovation and direct to integrated home renovation service providers that specifically target process guidance of CAs.

### *3.3. Supply*

Looking at the above analysis and the situation of the supply actors, there is definitely a need for better supply chain integration to support living-cost neutral renovations. The renovation sector is highly fragmented and consists mainly of SME's with insufficient R&D means, knowledge and time (Mlecnik & Artola, 2015; Mlecnik et al., 2019). Construction and installation companies are barely active in demand creation (RVO, 2014), and in the follow-up of the installations (Gram-Hanssen & Susse, 2018). They are difficult to engage as they like to avoid risks compared to business as usual (Brocklehurst et al., 2021). For zero-on-the-meter renovation there are chances to improve building concepts and installations as well as process guidance (Leidelmijer et al., 2017). Unfortunately, the Energy Leap programme (Stroomversnelling) did not lead to the expected market upscaling, also due to a lack of continuous guidance of homeowners (Stutvoet, 2018).

Supply activating policy focuses mainly on standardization and cost efficiency by means of industrialization and digitization (TKI Urban Energy, 2019; TNO, 2019), but supply chain collaboration is key for supplying integrated home renovation services. Essential is the systemic collaboration with neutral trusted advisers (Tjørring & Gausset, 2016; Mlecnik et al, 2019) such as real estate professionals, financial actors (banks, ESCo's, insurance companies), authorities and non-profit organisations that can manage customer relationships (Mlecnik and Artola, 2015; Brocklehurst et al., 2021). Other key factors are the establishment of stable consortia and efficient team work (COHERENO, 2016; Grasset & Scoditti, 2019), the integration of quality assurance (RGS NL, 2016; Brocklehurst et al., 2021) for customer confidence (COHERENO, 2016), planning to maximize energy savings (Schulze Darup, 2019); step-wise approaches for CAs (Energy.nl, 2016), social marketing (van Hal, 2014), and efficient customer communication (Rutten, 2015; van der Schoor, 2020). The financing arrangements need to be coupled to quality and energy performance (European Union, 2018: Art. 33).

Interviewees acknowledged the specific complexities of condominium renovations and point to the need for processes that integrate specific incentives, guarantees and policies to support CA decision-making (I-1; I-2; I-3; I-5; I-7). They confirmed the importance of integrated offers (I-2; I-6; I-7) and the need to work closely together with CA administrators and managers (I-1; I-4; I-5; I-6), neutral advisors or architects (I-1; I-3; I-4; I-5; I-7), financing intermediaries that can cover market failures (I-1; I-3; I-5; I-7), municipalities (I-1; I-2; I-6), energy providers - particularly energy cooperatives (I-2; I-3; I-6) -, and specialized communication agents that can connect with various types of stakeholders (I-3; I-5; I-6). Also they pointed to a current lack of knowledge and training for contractors and installers (I-3; I-6), and lack of the guarantees these actors provide (I-5; I-7).

## **4. Discussion and outlook**

The analysis results supported the establishment and development of a new Dutch non-profit organization "WNR", that has a specific mission to support the upscaling of the market for living-cost neutral condominium renovations. As a service desk WNR now actively approaches CAs and supports energy renovation decision-making during CA assembly meetings, in view of progressing to offering a

step-by-step integrated approach including feasibility studies, design plans, execution and quality assurance of condominium renovations (Goossen & Rose, 2020). As a unique customer value WNR offers a 30-year guarantee for the energy performance after renovation, aiming at about 90% energy reduction on building level after renovation. WNR will work together with a pool of advisors and contractors that will be trained and certified to offer living-cost neutral condominium renovations. WNR is supported by actors who already delivered successful condominium renovations using this framework (Goossen, 2019). WNR also progressed to working together with local authorities. Further strengthening of supply chain collaborations is planned in view of addressing the issues described previously.

## 5. Conclusion

This study aimed to determine how living-cost neutral renovations of condominiums owned by condominium associations (CAs) can be upscaled. The research used literature and in-depth interviews with experts to determine chances from the perspectives of policy, demand and supply chain development.

The upscaling of living-cost neutral renovations fits well within European and national policy, particularly when the goal is to combine energy neutrality with living cost neutrality. From a policy perspective it is important to also address a healthy indoor climate and equal access to financing for all members of a CA. European policy is in favour of more integration of advice, execution, financing and process guidance to unburden dwellers, and supports the development of integrated home renovation services and energy performance contracting. In the Netherlands this development is not yet in full view. While policy makers address individual homeowners and gas-free district approaches, the intermediate level of renovating buildings with multiple owners deserves specific further attention. Specifically CA administrators and managers require integrated process guidance towards deep renovation.

There is a huge potential in the Netherlands to renovate condominiums owned by CAs. The pathway to do so is blocked by various hurdles but also new opportunities arise to stimulate collective action and better management of condominiums. An appropriate offer for CAs that integrates performance guarantees and administrative and financing solutions could possibly seduce more CAs to start a deep renovation. Bundling of renovation demand could further stimulate upscaling and innovation of the supply chain.

The duration and the complexity of CA decision-making processes should not be underestimated. Customized solutions are needed to approach and consult CAs, taking into account possible legal barriers, administrative issues, detailed performance assessment, guarantee plans for CAs and service providers alike, and financial planning making use of reserve funds and multi-annual maintenance plans. In this sector a transformation is needed via open innovation and new supply chain partnerships that are trained and certified for providing quality, energy performance guarantees and result oriented collaboration. WNR already showed that these concerns and complexities can also be transformed into a viable business model.

## Acknowledgements

The project WNR was implemented with support from the MMIP 3&4 scheme of the Ministry of Economic Affairs & Climate Change and the Ministry of the Interior & Kingdom Relations. The Dutch participation to the IEA EBC Annex 75 “Cost-effective Building Renovation at District Level Combining Energy Efficiency & Renewables” was done with the support from EIT Climate-KIC and the Netherlands Enterprise Agency (RVO).

## References

- AEDES & Woonbond (2018) Sociaal Huurakkoord 2018, <https://www.aedes.nl/artikelen/klant-en-wonen/huurbeleid/huurprijsbeleid/huurders-en-woningcorporaties-stemmen-in-met-nieuw-sociaal-huurakkoord.html>, consulted on 25/06/2021.
- Aydin, E., Brounen, D. & N. Kok (2020) The Capitalization of Energy Efficiency: Evidence from the Housing Market. In: Journal of Urban Economics, 117, art. 103243.

Balcombe, P., D. Rigby & A. Azapagic (2013) Motivations and barriers associated with adopting microgeneration energy technologies in the UK, Renewable and Sustainable Energy Reviews, 22, 655-666.

Bos, J., Verberk, M. & M. Warnaar (2020) Kunnen woningeigenaren energie-investeringen betalen? NIBUD, The Hague.

Brocklehurst, F., Morgan, E., Greer, K., Wade, J., & G. Killip (2021) Domestic retrofit supply chain initiatives and business innovations: an international review, Buildings and Cities, 2(1), 533–549, DOI: <http://doi.org/10.5334/bc.95>.

Brounen, D. & N. Kok (2011) On the Economics of Energy Labels in the Housing Market. In: Journal of Environmental Economics and Management, 62 (2), 166-179.

BZK (2020) Stand van zaken Klimaatakkoord Gebouwde Omgeving, Kamerbrief Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, Directoraat-Generaal Bestuur, Ruimte en Wonen, Directie Bouwen en Energie, Kenmerk 2020-0000558548.

CBS (2016) Aantallen en kenmerken van Verenigingen van Eigenaren – een verkennend onderzoek, Centraal Bureau voor de Statistiek, Centraal Bureau voor de Statistiek, Den Haag/Heerlen/Bonaire, ISBN: 978-90-357-1828-9.

Cattaneo, C. (2019) Internal and external barriers to energy efficiency: which role for policy interventions?, Energy Efficiency, 12, 1293–1311.

Changeworks, University of Maastricht, Energy Cities (2020) Boosting energy retrofits in condominiums: Key policy recommendations for EU, national and regional policy makers, report Interreg North-West Europe project ‘ACE-Retrofitting’, ISBN: 978-2-490384-18-1.

COHERENO (2016). COHERENO — collaboration for housing nZEB renovation, Intelligent Energy Europe project (2012–2016), final report, TU Delft, Delft.

CPB (2020) Kansrijk Woonbeleid - Update 2020, Centraal Planbureau, Den Haag.

Ebrahimigharehbaghi, S., Q. Qian, F. Meijer & H. Visscher (2019) Unravelling Dutch homeowners’ behavior towards energy efficiency renovations: What drives and hinders their decision-making?, Energy Policy, 129, 546-561.

Energy.nl (2021) Zet je VvE op Groen: concrete stappen naar vergaande verduurzaming, Energy.nl, <https://energy.nl/zet-je-vve-op-groen/>, consulted on 25/06/2021.

European Commission (2019) Aanbeveling (EU) 2019/786 van de Commissie van 8 mei 2019 betreffende de renovatie van gebouwen (Kennisgeving geschied onder nummer C(2019) 3352), Publicatieblad van de Europese Unie 16/05/2019, European Commission, Brussels, <https://eur-lex.europa.eu/legal-content/NL/TXT/PDF/?uri=CELEX:32019H0786&from=GA>.

European Commission (2020). Een renovatiegolf voor Europa – groenere gebouwen, meer banen, hogere levenskwaliteit, mededeling van de commissie aan het Europees Parlement, de Raad, het Europees Economisch en Sociaal Comité en het Comité van de Regio’s, Europese Commissie, Brussel.

European Union (2018) Richtlijn (EU) 2018/844 van het Europees Parlement en de Raad van 30 mei 2018 tot wijziging van Richtlijn 2010/31/EU betreffende de energieprestatie van gebouwen en Richtlijn 2012/27/EU betreffende energie-efficiëntie, Publicatieblad van de Europese Unie 19/06/2018, <https://eur-lex.europa.eu/legal-content/NL/TXT/PDF/?uri=CELEX:32018L0844&from=EN>.

Filippidou, N., Nieboer, N. & H. Visscher (2019). Effectiveness of energy renovations: a reassessment based on actual consumption savings, Energy Efficiency, 12 (1), 19-35.

Goossen, C.-P. (2019) New Finance model for apartments to approaches neutral living expenses before and after the EnerPHit renovation, Paper 23rd International Passive House Conference 2019, Gaobeidian, China.

Goossen, C.-P. & C. Rose (2020) Appartementengebouwen woonlastenneutral renoveren, Gids voor de Vereniging van Eigenaars, Stichting WNR.

Gram-Hanssen, K. & G. Susse (2018) Energy performance gaps: promises, people, practices, Building Research & Information, 48 (1), <https://doi-org.tudelft.idm.oclc.org/10.1080/09613218.2017.1356127>.

Grasset, H. & E. Scoditti (2019) EE renovation market mechanisms, trends and barriers, STUNNING Project report D4.1 (Horizon 2020 grant agreement No 768287).

Greer, K., Wade, J., Brocklehurst, F., Morgan, E. & G. Killip (2020) International review of domestic retrofit supply chains, Final report, BEIS research paper No 2021/023, Department for Business, Energy & Industrial Strategy, UK.

Hal, A. van (2014) De Fusie van Belangen 2.0, het verhaal achter een perspectiefverschuiving, Center for Entrepreneurship & Stewardship, Nyenrode Business Universiteit.

Klimaatberaad (2019) Klimaatakkoord. <https://www.klimaatakkoord.nl/documenten/publicaties/2019/06/28/klimaatakkoord>.

Konstantinou, T. & M. Haase (2022) Business Models for cost-effective building renovation at district level combining energy efficiency & renewables (Annex 75- D2), International Energy Agency, submitted for publication.

Langley, M., T. Bouman & L. Steg (2020) De waarden achter klimaatgedrag: Hoe persoonlijke waarden en waargenomen groepswaarden klimaatgedrag motiveren en versterken, Mens en Maatschappij, 95 (3), 175-196.

Leidelmeijer, K., Borsboom, W., Vliet, M. van, Jacobs, P., Cozijnsen, E. & P. de Jong (2017) Opschaling nul op de meter, waardevolle lessen die je niet moet missen, VV+ magazine, december 2017, 26-35.

Lindenberg, S. & L. Steg (2007) Normative, gain and hedonic goal-frames guiding environmental behavior, Journal of Social Issues, 63, 1, 117-137.

Mlecnik, E. & I. Artola (2015) Realisatie van BEN renovaties van eengezinswoningen in Vlaanderen: hindernissen en kansen voor bedrijven, Passiefhuis-Platform vzw & Vlaams Energieagentschap, <https://energiesparen.login.kanooh.be/sites/default/files/atoms/files/aanbodzijde.pdf>, consulted on 25/06/2021.

Mlecnik E., Straub, A. & T. Haavik (2019) Collaborative business model development for home energy renovations, Energy Efficiency, 12 (1), 123–138, <https://doi.org/10.1007/s12053-018-9663-3>.

Mlecnik E. (2021) WNR – Kansen voor de opschaling van Woonlasten-Neutraal Renoveren in Nederland, MMIP-IEBB report, TU Delft, <https://repository.tudelft.nl/islandora/object/uuid%3A4719444c-fd58-442e-b569-c087b23e7293>.

Mlecnik E. & J.M. Hidalgo-Betanzos (2022) Policy instruments for cost-effective building renovation at district level combining energy efficiency & renewables (Annex 75), International Energy Agency, submitted for publication.

Paradies, G., Beekman, L., Ooms, M., de Koning, N., Mulder, G., van Baar M., Brester, C., Cremers, R., Schneijdenberg, J. & van Winden, J. (2017) De Duurzame VvE. Rapportage eerste fase, Topsector Energie - Samenwerking Topsector Energie en Maatschappij (STEM), TESE115014.

PBL (2020) Klimaat- en energieverkenning 2020. Planbureau voor de Leefomgeving, Den Haag.

Pettifor, H., Wilson, C. & G. Chryssochoidis (2015) The appeal of the green deal: Empirical evidence for the influence of energy efficiency policy on renovating homeowners, Energy Policy, 79, 161-176.

Renovatieversneller (2020) <https://derenovatieversneller.nl/>, consulted on 25/06/2021.

RGS NL (2016) Kwaliteit in Balans Normenboek 2016, <https://www.rgsl.nl/publicaties/kwaliteit-in-balans-normenboek-2016/>, consulted on 25/06/2021.

Rijksoverheid, VNG, Interprovinciaal Overleg & Unie van Waterschappen (2020), Programma Aardgasvrije Wijken (PAW), <https://www.aardgasvrijewijken.nl/>, consulted on 25/06/2021.

Ringelberg, S. (2019) VvE's zijn de vergeten startmotor van de Energietransitie, <https://www.linkedin.com/pulse/vves-zijn-de-vergeten-startmotor-van-energietransitie-sven-ringelberg/?originalSubdomain=nl>, consulted on 25/06/2021.

Rutten, M. (2015) Van Maken naar Raken, een gezonde organisatie door de klant centraal te stellen in de bouw-, installatie- en vastgoedsector, Constructief, ISBN 9789081583831.

RVO (2014) Blok voor Blok: de bevindingen, Grootchalige energiebesparing in de bestaande woningbouw, Rijksdienst voor Ondernemend Nederland, Den Haag, <https://www.rijksoverheid.nl/documenten/rapporten/2014/06/23/evaluatierapportage-blok-voorblok>, consulted on 25/06/2021.

SaveTheHomes (2021) Horizon 2020 project, <https://savethehomes.org/>, consulted on 25/06/2021.

Schalkwijk, M. (2018) Energie besparen doe je nu (S26) Eindrapportage campagne-effectonderzoek, Kantar, Amsterdam.

Schilder, F. & M. van der Staak (2020) Woonlasten neutraal koopwoningen verduurzamen - Verkenning van de effecten van beleids- en financieringsinstrumenten, Planbureau voor de Leefomgeving, rapport 4152, <https://www.pbl.nl/publicaties/woonlasten-neutraal-koopwoningen-verduurzamen>, consulted on 25/06/2021.

Schorel, J. & I. Opstelten (2018) Objectgebonden financiering van verdergaande energiebesparende maatregelen (bij grondgebonden woningen), Stroomversnelling, Den Haag.

Schoor, T. van der (Ed.) (2020) Nul op de meter: hoe verder met energierenovatie? Kenniscentrum Noorderruimte, Hanzehogeschool Groningen.

Schultz, P., J. Nolan & R. Cialdini (2007) The constructive, destructive, and reconstructive power of social norms, *Psychological Science*, 18, 5, 429-434.

Schulze Darup, B. (2019) Kostengünstiger und zukunftsfähiger Geschosswohnungsbau im Quartier, Projektbericht Deutsche Bundesstiftung Umwelt (DBU AZ 33119/01-25).

SER (2018) Voortgangsrapportage Energieakkoord 2018 en 5 jaar borging. Den Haag: Sociaal-Economische Raad.

Siewers, C. & A. Luijk-Van Veldhuizen (2018) Kleine VVE's, rapport Stichting VVE-Belang.

Steenbekkers, A., Fransman, R., de Kluijzenaar, Y. & P. Flore (2021) Woningverduurzaming: willen en kunnen betekent nog niet doen - Drijfveren en ervaren barrières bij woningeigenaren, Sociaal en Cultureel Planbureau, The Hague.

Stutvoet, E. (2018) Energietransitie: omarm de complexiteit, A+BE Architecture and the Built Environment, 18, TU Delft, ISBN 978-94-6366-070-9, <https://doi.org/10.7480/abe.2018.18>.

Tjørring, L. & Q. Gausset (2016) Energy Renovation Models in Private Households in Denmark. In: J. Hoff & Q. Gausset (Eds.), *Community Governance and Citizen Driven Initiatives in Climate Change Mitigation*, Routledge, London, 89-106.

TKI Urban Energy (2019) Versnelling van energierenovaties in de gebouwde omgeving (MMIP 3) Meerjarig Missiedreven Innovatieprogramma, 6 september 2019, <https://www.topsectorenenergie.nl/sites/default/files/uploads/MMIP/MMIP%203%20-%20Versnelling%20van%20energierenovaties%20in%20de%20gebouwde%20omgeving.pdf>, consulted on 25/06/2021.

TNO (2019) Programmabeschrijving IEBB, Bijlage bij IEBB voorstel, MMIP 3 Versnelling Energierenovaties in de gebouwde omgeving en MMIP 4 Duurzame warmte en koude in de gebouwde omgeving, IEBB consortium partners.

Visser, S., Wagner, M., de Graaf, C., Heeres, H., de Vreede, O., Montenarie, R., Boer, K., Boutkan, E., de Heus, Y., Sieh, M., Rozemeijer, S. & H. van Terwisga (2019) Roadmap Human Capital Topsectoren 2020-2023, <https://www.topsectoren.nl/human-capital/documenten/kamerstukken/2019/november/12-11-19/roadmap-hc-topsectoren>, consulted on 25/06/2021.

Vringer, K., Middelkoop, M. van & N. Hoogervorst (2014) Energie besparen gaat niet vanzelf, evaluatie energiebesparingsbeleid voor de gebouwde omgeving. PBL beleidsstudie, december 2014.

Weatherall, D., McCarthy F. & S. Bright (2018) Property law as a barrier to energy upgrades in multi-owned properties: insights from a study of England and Scotland, *Energy Efficiency*, 11, 1641-1655.

Wilson, C., Crane, L. & G. Chryssochoidis (2015) Why do homeowners renovate energy efficiently? Contrasting perspectives and implications for policy, *Energy Research & Social Science*, 7, 12-22.

WRR (2016) Klimaatbeleid voor de lange termijn: van vrijblijvend naar verankerd, WRR-Policy Brief 5, Wetenschappelijke Raad voor het Regeringsbeleid, The Hague.