Radarweg 60
1043 NT Amsterdam
The Netherlands

www.tno.nl

T +31 88 866 50 10

TNO report

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Energy Poverty: A Science and Policy State of Play

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Author(s)	Caroline van Ooij, Anika Batenburg, Nam Chi Nguyen, Koen Straver
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Samenvatting

S.1. Introductie

De energiecrisis leidt tot een steeds groter aantal energiearme huishoudens in Europa
Voor de energiecrisis waren er ongeveer 35 miljoen Europese huishoudens die in energiearmoede leven. Dat betekent dat 8% van de Europese burgers onvoldoende toegang had tot goede energievoorzieningen in huis (zoals elektriciteit, warmte). Dit komt door diverse redenen waaronder het hebben van te weinig geld om de energierekening te betalen of het wonen in een slecht geïsoleerd huis met een lage energiekwaliteit.

De energieprijzen zijn de afgelopen tijd flink gestegen, waardoor het aantal energiearme huishoudens toeneemt. Dit is zorgwekkend voor huishoudens die hier problemen van ondervinden, maar vormt ook een bedreiging voor de energietransitie aangezien (toenemende) maatschappelijke ongelijkheid de algemene publieke steun voor de transitie kan ondermijnen. Omdat het succes en de versnelling van de energietransitie voor een groot deel afhangt van maatschappelijke steun, is het cruciaal om ondermijning te voorkomen.

Met het geven van een overzicht van zowel de wetenschappelijke als de beleidskant van het energiearmoedevraagstuk probeert dit rapport bij te dragen aan de brug tussen wetenschap en beleid. Daarnaast geeft dit overzicht inzicht in de mate waarin het energiearmoedebeleid overeenkomt met de onderzoeksresultaten op het gebied van energiearmoede (d.w.z. is het beleid in overeenstemming met evidence-based praktijken?). Ook geeft het kijken over de Nederlandse grenzen heen inzicht in wat er geleerd kan worden van bestaand energiearmoedebeleid in andere Europese landen.

S.2. Wetenschappelijke stand van zaken

Het wonen in energiearmoede heeft verschillende nadelige gevolgen
Energiearmoede is niet hetzelfde als algemene armoede. Er zijn huishoudens die niet onder de armoedegrens leven en in financiële moeilijkheden komen specifiek vanwege hun energierekening, en er zijn huishoudens met een laag inkomen die geen moeite hebben om hun energierekening te betalen. Er zijn een aantal kenmerken die energiearme huishoudens delen, maar ze vormen ook een diverse groep, wat het moeilijk maakt om een algemene definitie vast te stellen. In dit rapport gebruiken we de vaak gebruikte definitie waarbij energiearmoede wordt beschreven als een toestand waarin een huishouden onvoldoende toegang heeft tot goede energievoorzieningen in huis. Vanaf dit jaar (2023) publiceert het CBS jaarlijks Nederlandse energiearmoede cijfers aan de hand van indicatoren die gaan over 1) de betaalbaarheid van energie, 2) de woningkwaliteit, en 3) de mogelijkheid om een woning zelfstandig te verduurzamen.

Energiearmoede komt vaker voor bij bewoners met bepaalde kenmerken, studies suggereren dat deze kenmerken onder andere zijn: het hebben van een laag inkomen, lager opgeleid zijn, vrouw zijn, een beperking of ziekte hebben, en het hebben van een migratieachtergrond. Energiearme huishoudens wonen vaak in

slecht geïsoleerde huizen met een lage energiekwaliteit en, tenminste in Nederland, in sociale huurwoningen. Er wordt steeds meer onderzoek gedaan naar hoe verschillende kenmerken van energiearme huishoudens op elkaar kunnen inwerken en elkaar kunnen versterken op manieren die leiden tot slechtere leefomstandigheden. Dit is het onderzoeksgebied van intersectionaliteit. Het belangrijk om te noemen dat de huidige beschikbare onderzoeken naar kenmerken van energiearme huishoudens zijn gepubliceerd voor de energiecrisis. Onderzoek is een overwegend langzaam proces, met als mogelijk gevolg dat er nieuwe groepen energiearme huishoudens kunnen zijn ontstaan die nog niet door de huidige beschikbare studies worden herkend.

Onderzoek suggereert verschillende nadelige gevolgen van het leven in energiearmoede, zoals fysieke en mentale gezondheidsproblemen. Omdat energiearmoede een multidimensionaal begrip is, is het vaak moeilijk om oorzaak-gevolgrelaties te onderscheiden: zo kan een slechte gezondheid bijdragen aan energiearmoede of een gevolg zijn, en beide kunnen elkaar ook versterken.

Woningrenovatie, kleine energiebesparende maatregelen en advies kunnen helpen

Twee verschillende typen maatregelen die vaak worden ingezet om energiearme huishoudens te helpen met het verbeteren van hun leefsituatie zijn: 1) renovatiemaatregelen om de energie-efficiëntie van een woning te verbeteren (zoals isolatie), en 2) kleine energiebesparende maatregelen en energiebesparingsadvies.

Verschillende studies naar het eerste type maatregelen laten positieve resultaten zien. Vooral het mentale welbevinden van huishoudens lijkt hierdoor te verbeteren, hoewel ook fysieke effecten worden gevonden. Positieve resultaten zijn duidelijker zichtbaar wanneer er verschillende renovatiemaatregelen worden uitgevoerd, de bewoners een slechte gezondheid hebben en leven in woningen met een lage energiekwaliteit. Echter, resultaten suggereren ook dat de verbeteringen goed moeten worden uitgevoerd en bewoners tijdens het proces moeten worden ondersteund. Een renovatie kan namelijk als stressvol worden ervaren. Daarnaast zijn de effecten van een renovatie ook afhankelijk van (opvolging van) bijbehorende adviezen. Zo dienen huishoudens, wanneer hun woning net is geïsoleerd, advies te krijgen over het adequaat ventileren van hun woning.

De studies naar het tweede type maatregelen (het ontvangen van kleine energiebesparende maatregelen en energiebesparingsadvies) laten zien dat ze kunnen bijdragen aan veranderingen in energiegerelateerde gedragingen, het besparen van energie(kosten) en het verlichten van financiële lasten. Ook suggereren resultaten dat deze maatregelen bij kunnen dragen aan het ervaren van een gevoel van controle over het binnenklimaat, met positieve gevolgen van dien. De effecten van energiebesparingsadvies verbeteren wanneer het advies is aangepast op de specifieke situatie van het huishouden (d.w.z. elk huishouden heeft andere gebruikspatronen) en een energiecoach (d.w.z. de gever van het advies) meerdere malen op bezoek komt. Deze resultaten komen voort uit een klein aantal studies en bieden eerste inzichten, maar we hebben te weinig empirisch onderzoek gevonden om solide conclusies te trekken. Voor huishoudens in woningen met een lage energiekwaliteit of huishoudens die erg weinig energie gebruiken, hebben kleine energiebesparende acties waarschijnlijk een minder groot effect en zijn grondige verduurzamingsmaatregelen passender. Daarmee kunnen

waarschijnlijk ook eerder gezondheidsproblemen door vocht en schimmel worden opgelost.

S.3. Energiearmoedebeleid en initiatieven in Europa

Beleid om energiearme huishoudens te helpen is toegenomen, maar de meeste beleidsmaatregelen missen een langetermijnstrategie
De afgelopen jaren heeft de EU haar inspanningen om veilige en toegankelijke energie voor Europese huishoudens te garanderen verhoogd. Een belangrijke stap hierin was de introductie van het ‘Clean Energy for All-package’. Dit pakket beschrijft verschillende richtlijnen voor lidstaten, waaronder het monitoren en rapporteren van het aantal energiearme huishoudens, en het prioriteren van energiearme huishoudens in beleidsmaatregelen over energie-efficiëntie.

Er zijn verschillen tussen Europese landen wat betreft hun energiearmoedebeleid. Europese landen die het begrip energiearmoede hebben gedefinieerd hebben vaker beleid specifiek gericht op energiearme huishoudens (bijv. in het Verenigd Koninkrijk). Landen zonder officieel vastgestelde definities hebben daarentegen vaak geen specifiek energiearmoedebeleid en richten hun beleid op kwetsbare huishoudens in het algemeen (bijv. in Duitsland en in Nederland, hoewel er op het moment van schrijven veel ontwikkelingen in Nederland gaande zijn).

De energieprijzen zijn in 2022 enorm gestegen. Om te voorkomen dat de energieprijzen verder stijgen en om de negatieve effecten van hoge prijzen op (energiearme) huishoudens te verminderen, hebben de EU en verschillende Europese landen acute beleidsmaatregelen geïmplementeerd. De maatregelen van de EU zijn vooral gericht op het drukken van de gasprijs. De maatregelen van verschillende Europese landen betreffen met name financiële ondersteuning van huishoudens, zoals een prijsplafond voor energie en energietoeslagen. In sommige gevallen is er ook sprake van extra ondersteuning voor huishoudens met een laag inkomen. In de periode van september 2021 tot oktober 2022 hebben Europese landen tezamen €674 miljard uitgegeven aan deze typen maatregelen. Hoewel er in sommige gevallen ondersteuning is gericht op 'kwetsbare' of lage-inkomenshuishoudens, zijn de meeste maatregelen gericht op huishoudens in het algemeen. Hoewel deze maatregelen doeltreffend zijn in het vergroten van koopkracht, kosten ze ook veel geld en geven ze ondersteuning aan huishoudens die geen extra ondersteuning in hun koopkracht nodig hebben.

Daarnaast is het belangrijk te noemen dat deze maatregelen (vermoedelijk) effectief zijn op de korte termijn, maar op de lange termijn als minder doeltreffend worden beschouwd. Een van de redenen hiervoor is dat financiële ondersteuning van energiearme huishoudens een van de onderliggende problemen van energiearmoede niet oplost: de energetische kwaliteit van de woning.

S.4. Conclusie

Beleidsmaatregelen moeten aangepast zijn aan de specifieke doelgroep
Hoewel er ook overeenkomsten zijn, is het belangrijk te erkennen dat energiearme huishoudens een diverse groep huishoudens vormen met verschillende kenmerken en behoeften. Verschillende soorten maatregelen helpen huishoudens op verschillende manieren: waar renovaties bij kunnen dragen aan het verbeteren van

gezondheid, dragen energiebesparingsadvies en kleine energiebesparende maatregelen bij aan een gevoel van controle over het binnenklimaat en het verminderen van energieverbruik en kosten. De effectiviteit van de maatregelen is echter afhankelijk van verschillende factoren, zoals de gezondheid van de bewoners voorafgaand aan de renovatie, de ervaren stress tijdens de renovatie en de specifieke energiebehoeften van een huishouden. Deze bevindingen benadrukken de noodzaak van op maat gemaakte maatregelen om (de nadelige gevolgen van) energiearmoede te bestrijden.

Huishoudens dienen ook structureel geholpen te worden
Als we kijken naar de Nederlandse en Europese beleidsmaatregelen om de effecten van hoge energieprijzen te verzachten wordt duidelijk dat maatregelen in de eerste plaats gericht zijn op het verlichten van financiële lasten. Aangezien energiearmoede bestaat uit verschillende dimensies (en niet alleen betaalbaarheid van energie), is het waarschijnlijk dat de huidige maatregelen niet voldoende zijn om huishoudens die met de gevolgen van energiearmoede worden geconfronteerd te helpen. Om energiearme huishoudens structureel te helpen dient verduurzaming van hun woningen meer prioriteit te krijgen. Daarmee wordt niet alleen de woningkwaliteit verbeterd, maar kan ook de energierekening verlaagd worden en gezondheid van huishoudens worden verbeterd. Toekomstig beleid kan hier een bijdrage aan leveren, en eveneens rekening houden met het feit dat de rol van huishoudens in het energiesysteem steeds belangrijker en prominenter wordt. Energiearme huishoudens moeten deze rol ook kunnen vervullen om mee te gaan in de energietransitie.

Er is meer praktijkgericht onderzoek nodig voor effectieve uitvoer en betere inzet van middelen in Nederland
Om inzicht te krijgen in welke maatregelen het meest geschikt zijn voor verschillende Nederlandse energiearme huishoudens is meer onderzoek in Nederland nodig. Huidige onderzoeken zijn vaak uitgevoerd in andere landen, en richten zich niet op energiearmoede maar op specifieke dimensies van het probleem (bijv. financiële stress en/of gezondheid). Toekomstig onderzoek kan een combinatie van verschillende onderzoeksmethoden gebruiken om een veelomvattend inzicht te verkrijgen in (ervaringen van) energiearme huishoudens. Ook dient er aandacht te zijn voor effectieve manieren om huishoudens te benaderen, aangezien deze doelgroep vaak lastig te bereiken is.

Nederland zet de eerste stappen, maar uitwerking en verankering van beleid is nodig
Op basis van beschreven wetenschappelijke bevindingen en het beleid van andere Europese landen wordt duidelijk dat de aanpak van energiearmoede specifiek beleid vereist. Om energiearmoedebeleid te ontwikkelen, en om de effectiviteit van dit beleid te monitoren, is het noodzakelijk om energiearmoede indicatoren te bepalen. Met de energiearmoede indicatoren die vanaf dit jaar jaarlijks door het CBS worden gepubliceerd, zijn de indicatoren voor Nederland bepaald. Alleen met indicatoren is het mogelijk om de voortgang en doeltreffendheid van beleid te monitoren. Ook vanuit de EU wordt steeds meer grip op energiearmoede gevraagd. Met behulp van indicatoren, maar ook met een nationaal plan om het aantal energiearme huishoudens terug te brengen. De eerste stappen voor Nederland zijn hierin gezet, maar nog ni et uitgewerkt en verankerd.

Summary

S.1. Introduction

The energy crisis contributes to increasing numbers of energy poor households in Europe
Before the energy crisis, there were around 35 million European households living in energy poverty, meaning that nearly 8% of the European citizens do not have adequate access to energy resources (i.e., electricity, warmth). This is because they cannot afford to pay the energy bill or live in a poor quality, energy inefficient house.

Energy prices have risen significantly recently, increasing the number of energy poor households. This is worrisome for those households that are directly affected, but it also poses a threat for the energy transition as increasing societal inequalities can undermine the general public support for the energy transition. As the success and acceleration of the energy transition largely depends on society, it is crucial to avoid this undermining.

By providing an overview of both the scientific and policy state of play regarding energy poverty this report contributes to bridging energy poverty science and policy practices. Looking at both the policy and research state of play allows to gain insight in the extent to which energy poverty policies match energy poverty research findings (i.e., are policies in line with evidence-based practices?). In addition, looking beyond the Dutch borders gives insight in what can be learned from existing energy poverty policies in other European countries.

S.2. Scientific state of play

Living in energy poverty results in various adverse consequences
Energy poverty is not the same as general poverty. There are non-poor households who experience financial difficulties specifically due to their energy bills and there are poor (low-income) households who have no difficulty paying their energy bill. Energy poor households constitute a diverse collection of households with various characteristics, making it hard to establish a generally agreed definition. In this report we use the commonly used definition that describes energy poverty to be a state in which households have insufficient access to adequate energy resources at home. Starting this year (2023), CBS will publish annual Dutch energy poverty data using indicators that deal with 1) energy affordability, 2) housing quality, and 3) the ability to independently make one’s home more sustainable.

Energy poverty is more common among residents with certain characteristics, studies suggest the following characteristics: having a low income, having limited educational attainment, being women, dealing with disabilities and/or illness and having a migration background. Energy poor households often live in energy inefficient dwellings and, at least in the Netherlands, in social housing. More and more research is performed on how different characteristics of energy poor households may interact and reinforce each other in ways that contribute to more adverse living situations. This is the research area of intersectionality. It is important to mention that the currently available studies on characteristics of energy-poor

households were published before the energy crisis. Research is a predominantly slow process, with the possible consequence that new groups of energy poor households may have emerged that are not yet recognized.

Research suggests various adverse consequences of living in energy poverty, such as physical and mental health issues. Because energy poverty is a multi-dimensional construct, it is often hard to distinguish cause and effect relationships: poor health for example can contribute to energy poverty or be a consequence, and both can also reinforce each other.

Home renovation, small energy-saving measures and advice can help
Two different types of measures often used to help energy poor households are: 1) renovation measures to improve a home's energy efficiency (such as insulation), and 2) small energy-saving measures and energy-saving advice.

Several studies on the effectiveness of heat and energy efficiency improvements show positive results. In particular, they seem to improve the mental well-being of households, although physical effects are also found. Positive results are more evident when several renovation measures are implemented, residents have poor health and live in homes with low energy quality. Results also suggest that improvements should be carried out properly and residents should be supported during the process; a renovation can be perceived as stressful. The effects of a renovation also depend on (following) advice. For example, when a homes has just been insulated, households should be advised on how to adequately ventilate their homes.

Studies into receiving small energy-saving measures and energy-saving advice show that they can contribute to changes in energy-related behaviours, saving energy (costs) and easing financial burden. Results also suggest that these measures can contribute to experiencing a sense of control over one’s indoor climate, resulting in positive consequences. The effects of energy-saving advice improve when the advice is tailored to the specific situation of the household (i.e. each household has different energy usage patterns) and an energy coach (i.e. the giver of the advice) makes several visits. These results come from a small number of studies and provide initial insights, but we have found too little empirical research to draw solid conclusions. For households in homes with low energy quality or households that use very little energy, small energy-saving actions are likely to have a lesser effect, and thorough sustainability measures are more appropriate. These are also more likely to solve health problems caused by damp and mould.

S.3. Energy poverty policies and initiatives across Europe

Policy efforts to help energy poor households increased, but most policies lack long term strategies
Over the last couple of years, the EU has increased its efforts to ensure safe and accessible energy for European households. An important step in this was the introduction of the “Clean Energy for All-package”. This package sets out several directives for Member States, including monitoring and reporting the number of energy poor households, and prioritizing energy poor households in policies on energy efficiency.

There are differences between European countries in terms of their energy poverty policies. European countries that have defined the concept of energy poverty are more likely to have policies specifically targeting energy poor households (e.g. in the UK). In contrast, countries without officially established definitions often do not have specific energy poverty policies and focus their policies on vulnerable households in general (e.g. in Germany and in the Netherlands, although at the time of writing many developments are ongoing in the Netherlands).

Energy prices rose significantly in 2022. To prevent energy prices from rising further and to reduce the negative effects of high prices on (energy poor) households, the EU and various European countries have implemented acute policy measures. The EU measures mainly focus on pushing down the gas price. The measures of several European countries mainly concern financial support for households, such as an energy price cap and energy surcharges. In some cases there was additional support for low-income households. In the period from September 2021 to October 2022, European countries collectively spent €674 billion on these types of measures. While there is in some cases support targeted at 'vulnerable' or low-income households, most measures are aimed at households in general. While effective in increasing purchasing power, these measures are also costly and provide support to households that do not need additional support in their purchasing power.

In addition, it is important to mention that these measures are (presumably) effective in the short term, but are considered less effective in the long term. One reason for this is that financial support for energy poor households does not solve one of the underlying problems of energy poverty: the energy quality of their homes.

S.4. Conclusion

Policy measures should be adapted to the specific target group
Although there are similarities, it is important to recognise that energy poor households constitute a diverse group of households, with different characteristics and needs. Different types of measures help households in different ways: where renovations can contribute to improving health, energy-saving advice and small energy-saving measures contribute to a sense of control over the indoor climate and reduce energy consumption and costs. However, the effectiveness of the measures depends on several factors, such as residents' health prior to renovation, perceived stress during renovation and the specific energy needs of a household. These findings highlight the need for tailored measures to combat (the adverse effects of) energy poverty.

Households also need structural help
Looking at Dutch and European policy measures to mitigate the effects of high energy prices, it becomes clear that measures are primarily aimed at easing financial burdens. Since energy poverty consists of several dimensions (and not just affordability of energy), it is likely that current measures are not sufficient to help households facing the effects of energy poverty. To structurally help energy poor households, making their homes more sustainable should be given higher priority. This will not only improve housing quality, but can also reduce energy bills and improve households' health. Future policies can contribute to this, and also take into account that the role of households in the energy system is becoming increasingly

important and prominent. Energy poor households must also be able to fulfil this role in order to keep up with the energy transition.

More practice-oriented research is needed for effective implementation and better deployment of resources in the Netherlands

To understand which measures are most suitable for different Dutch energy poor households, more research is needed in the Netherlands. Current studies have often been conducted in other countries, and do not focus on energy poverty but on specific dimensions of the problem (e.g. financial stress and/or health). Future research could use a combination of different research methods to gain a comprehensive understanding of (experiences of) energy poor households. Effective ways to approach households should also be considered, as this target group is often difficult to reach.

The Netherlands takes first steps, but elaboration and embedding of policy is needed

Based on the described scientific findings and the policies of other European countries, it becomes clear that tackling energy poverty requires specific policies. To develop energy poverty policies, and to monitor the effectiveness of these policies, it is necessary to define energy poverty indicators. The energy poverty indicators published annually by CBS starting this year determined the indicators for the Netherlands. Only with indicators is it possible to monitor the progress and effectiveness of policies. The EU is also increasingly demanding a grip on energy poverty by using indicators, but with a national plan to reduce the number of energy poor households as well. The first steps for the Netherlands have been taken, but have not yet been worked out and embedded.

Contents

1 Introduction

1.1 Energy poverty in a rapidly changing world

In total, there are around 35 million European households living in energy poverty in 2020 (Eurostat, 2021). This means that (in 2020) nearly 8% of the European citizens did not have adequate access[1] to energy resources at home (i.e., electricity, warmth) because they could not afford to pay their energy bills or lived in a poor quality, energy inefficient house. This is at odds with the concept of energy justice and Sustainable Development Goal 7, which argue that all individuals should have access to energy that is affordable, safe, and sustainable, and sufficient to maintain a basic standard of living (McCauley et al., 2013; United Nations, 2015). The energy transition as it is currently organized and the current energy crisis make this presumably increasingly difficult to realise.

Box 1. Defining energy poverty

Despite advances conceptualising energy poverty, there is still no generally agreed definition and, as we will discuss in this report, countries differ in their description of the concept. In this report we use the commonly used definition that describes energy poverty to be a state in which a household has insufficient access to adequate energy services at home. In section 2.1 we will discuss this definition more elaborately.

One of the reasons for this is that the energy transition requires households to make their houses and lifestyles more sustainable and ready for the energy transition, for example by installing a heat pump or buy an electric vehicle. Although this allows more affordable energy costs on the long run (Faaij & Van den Brink, 2019), these measures require upfront investments and are therefore often only (or more easy) accessible to high income households (Borenstein & Davis, 2016; Carley & Konisky, 2020; Mullen & Marsden, 2016; Sunter et al., 2019). This makes it more difficult for energy poor households, who tend to be low-income households, to join the energy transition.

In addition, the energy prices increased significantly as a result of the war in Ukraine and the fact that energy supply is slow to respond to the post-COVID19 increase in energy demand. The increasing energy prices contribute to an increase in the number of households not able to pay their energy bills, which is worrisome for those households that are directly affected, but also poses a threat for the energy transition. Increasing societal inequalities can namely undermine the general public support for the energy transition (Straver et al., 2020). This should be avoided as the success and acceleration of the energy transition depends in large

[1] Although energy poverty in Europe and the Netherlands (i.e., inadequate access to energy resources) is an issue that should receive attention, we acknowledge that from a global perspective energy access in general is an even bigger issue: 770 million people have no access to electricity at all (IEA, n.d.). Since the focus of this report is on the European and Dutch context in particular we refer to energy poverty in the sense of insufficient access to adequate energy services at home. See section 2.1 for a more elaborate description.

part on society, and not only on sustainable technologies (Straver et al., 2020). After all, energy transition policies need societal approval and sustainable measures need to be purchased in order for them to enter into force.

All in all, energy poverty is a crucial part in realizing and accelerating the energy transition. Looking at both the policy and research state of play allows to gain insight in the extent to which energy poverty policies match energy poverty research findings (i.e., are policies in line with evidence-based practices?). In addition, looking beyond the Dutch borders gives insight in what can be learned from existing energy poverty policies in other European countries.

1.2 What is this report about?

This report provides an overview of the scientific and policy state of play related to energy poverty based on the situation in fall 2022. The world is rapidly changing (among others due to the energy crisis, the war in Ukraine and climate change) and there is a high rate of policy developments. Therefore, this report will be updated annually. As the intention is to see what challenges are important and which solutions might be available for the Netherlands, we focus on the Dutch situation and (similar) European countries.

In Chapter 2 we start by defining energy poverty (section 2.1) and describing the characteristics of energy poor households (section 2.2), possible consequences of living in energy poverty (section 2.3), and the effectiveness of measures to support energy poor households (section 2.4). In Chapter 3 we describe what policies the European Commission (EC) initiated to support energy poor households, targeted policies in various European countries (section 3.1), as well as recent developments in energy policies in response to the recent increase of energy prices (section 3.2). We conclude this report by reflecting on the current research available (section 4.1) and policies to see what additional possibilities there might be for The Netherlands to protect households from energy poverty (section 4.2).

1.3 For whom is this report intended?

This report is part of the Dutch national research program on energy poverty and provides the program with a knowledge base. The program is a collaboration between different Dutch provinces (Noord-Holland and Zuid-Holland) and the Ministries of the Interior and Kingdom Relations, of Social Affairs and Employment, and of Economic Affairs and Climate Policy. The program, and this report, aims to support local, regional and national policy makers and implementers with up-to-date and focused knowledge on energy poverty. Consequently, this report is intended for researchers involved in the program, (Dutch) policy makers and others interested in the topic.

2 Scientific state of play

This section summarizes the most recent scientific findings of studies into energy poverty. Currently the number of studies on energy poverty and policy effectiveness among Dutch households is limited. The research summarized in this report therefore mainly concerns research of the Global North. This section seeks to broadly identify the socio-economic groups, housing characteristics, and spatial locations deemed vulnerable to energy poverty in Europe and the Netherlands (section 2.2). This section also describes research into the consequences of energy poverty on an individual level, as well as studies into the effectiveness of measures to support energy poor households (section 2.3 and section 2.4).

2.1 Defining energy poverty

The term energy poverty was introduced by Boardman (1999) in reference to fuel poverty, a commonly used term in UK literature, and described as a situation at the intersection of energy efficiency, income and energy use (see Figure 1). Despite advances conceptualising energy poverty, there is still no generally agreed definition of the concept. As stated in Box 1 we use the commonly used definition that describes energy poverty to be a state in which a household has insufficient access to adequate energy resources at home. This definition is a simplified version of the most commonly used academic definition of Bouzarovski et al. (2021), and is similar to definitions adopted in earlier TNO reports (e.g., Mulder et al., 2021a).

Energy poverty is a multidimensional construct. Energy poor households deal with a combination of a low income, high energy costs and poor quality housing (Mulder et al., 2021a). In Mulder et al. (2021a) it is elaborately discussed which threshold values are used by TNO indicators to label households as energy poor households. The TNO indicators allow to measure the number of energy poor households with regards to 1) the affordability of energy, 2) housing quality and 3) the ability to independently renovate one’s home. Starting this year (2023), the Dutch Central Statistical Office (CBS) will publish numbers on Dutch energy poverty based on these three dimensions.

It is important to note that energy poverty is not the same as general poverty. Research by Bouzarovski and Tirado Herrero (2017) shows that there are non-poor households living in financial difficulties specifically because of their energy bills. On the other hand, there is research showing that there are poor (i.e., low-income) households who do not have difficulty paying their energy bill (Middelkoop et al., 2018). Because of this, it could be helpful to identify which elements contribute to an increased risk of energy poverty. This enables to determine who it affects, in order to create specific solutions and monitor this vulnerable group of households.

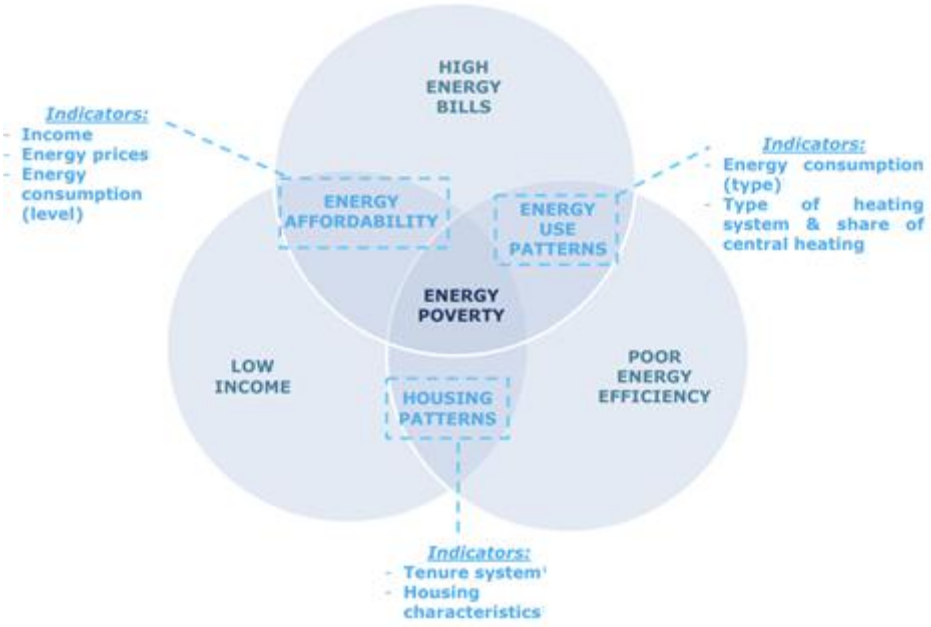

Figure 1. Energy poverty defined as the intersection of three distinct concepts (Boardman, 1999).

2.2 Energy poor households: who are they?

2.2.1 Socio-economic characteristics

Energy poverty has a high prevalence among low-income households (e.g., unemployed households or households on social benefits). Financial difficulties might lead to the inability to pay energy bills, making low-income households more prone to energy poverty. Energy expenses also represent a higher share of one's income when income is low, which contributes to energy poverty as well (i.e., high energy quote[2]).

An additional disadvantage is that having a low income restricts access to energy efficiency measures as this usually requires financial capital, making it more difficult for low-income households to adopt measures that save energy and energy costs (Carley & Konisky, 2020; Straver et al., 2020). Research shows that limited educational attainment is common among energy poor households compared to non-energy poor households. This puts energy poor households at a disadvantage, as navigating utility companies, financial subsidies, medical certifications and alternative methods for energy needs require a certain degree of knowledge and skills (Kearns et al., 2019).

Several other specific demographic categories are found to be prevalent among energy poor households as well. First of all, there is growing attention for a gender dimension to energy poverty: studies show an overrepresentation of single mothers with children and female retirees among energy poor households (Sánchez-

[2] The energy quote defines energy poverty as a (too) high share of income spent on gas and electricity costs (usually above 10%). This indicator is widely known, but also widely criticized due to excluding under-consumers of energy (e.g., households who turn down heating to save costs) and including over-consumers (e.g., rich households with high consumption patterns due to, among others, large dwellings). See for example Charlier and Legendre (2021).

Guevara Sánchez et al., 2020; Robinson, 2019). Studies indicate that this may be due to economic reasons (i.e., women tend to have lower incomes than men) and/or physiological reasons (i.e., women tend to be more sensitive to ambient temperatures and overrepresented by demographics such as older age, making them more prone to energy poverty; Feenstra & Clancy, 2020; Jessel et al., 2019).

Several studies also indicate that households with disabilities, long-term illness, or infirmity are overrepresented as they are more likely to have higher and non-negotiable energy needs related to their condition and often need adapted housing (Cronin de Chavez, 2017). Such households may risk entering a downward spiral between energy poverty and ill health (Middlemiss & Gillard, 2015; Snell, 2015; Ivanova & Middlemiss, 2022; Polimeni et al., 2022). On the one hand, if a person is energy poor and must deal with a lack of proper energy quality housing, they are more susceptible to illness. On the other hand, if a person is incapable of working due to ill health and/or disability, they will be less able to earn income to pay their energy bills .

Finally, even though academic work is still sparse, there also seems to be a bias of energy poverty toward households consisting of immigrants due to strong correlations between race/ethnicity and socioeconomic status, education level, and housing tenure (Bednar et al., 2017; Gúzman-Rosas, 2022).

2.2.2 Housing characteristics

In terms of housing characteristics, both European and Dutch studies indicate that energy poor households tend to live in energy inefficient apartments and houses that are poorly insulated and/or lack proper heating and cooling systems (Bartiaux et al., 2021; Kyprianou et al., 2019; Mulder et al., 2023). In addition, energy poor households more often use inefficient electrical appliances (i.e., old appliances are often cheaper to purchase, but consume more energy and are thus less cost-efficient; Bartiaux et al., 2021).

Considering the home ownership of energy poor households, research finds that many energy poor households live in rental homes (Bednar & Reames, 2020; Mashhoodi, 2020). To illustrate, 75% of the energy poor households in The Netherlands are renting their home from a social housing corporation (Mulder et al., 2021a). Even though these households may be able to pay their energy bills, they may have insufficient financial means to invest in sustainability or depend on the landlord for making their house more sustainable (Mulder et al., 2021a).

Current research is undecided about the interactions between energy poverty and geographical patterns, with studies finding both spatially homogeneous and heterogenous determinants across regional, national, district and neighbourhood levels (Bouzarovski & Tirado Herrero, 2017; Riva et al., 2021; Mashhoodi et al., 2019). In The Netherlands, energy poor households are strongly concentrated in the rural north and (south-)east of the country. The relatively low shares of energy poor households observed in the Randstad conurbation can be explained by the high population density in municipalities in the Randstad, where a few energy-poor districts can be found amidst a background of low energy poverty. Without this balancing effect, municipalities in the Randstad host more energy poor households than municipalities in the rest of the country. Importantly, localizing energy poor households across different districts depends on the energy poverty definition utilized and further research is needed to investigate the factors which explain such a spatial distribution in The Netherlands (Mulder et al., 2023).

2.2.3 Vulnerability among energy poor households

Individuals and socio-economic groups may experience various forms of disadvantage, which can happen simultaneously and can interact with and reinforce each other. Studying this issue is the field of intersectionality (Crenshaw, 1991). In this light, it is important to see that energy poor households are not only energy poor but face a multiplicity of problems related to characteristics such as income, housing, education, age, health and ethnicity. For example, an energy poor household may not only struggle with energy costs and/or low energy quality housing but also with characteristics such as illness, the presence of small children, a migration background or language barriers which negatively affect the ability to take (informed) action (Grossman & Kahlheber, 2017).

There is more and more attention in academic research for this issue, and some studies show that the ways in which a household struggles with energy poverty depends on the socio-economic group it belongs to and differs across regions and countries (e.g., Middlemiss, 2022). For example, single-person households and single-parent families, who are overrepresented among energy poor households (Mulder et al., 2023; Mashhoodi et al, 2018; Karpinska & Smiech, 2020), tend to be more prone to (long-term) income poverty and cannot share the energy cost burden (Jessel et al., 2019). They are often vulnerable as they face multiple socio-economic disadvantages (Sunikka-Blank & Galvin, 2021; Jalovaara and Andersson, 2017).

Also pensioners are likely to spend a high share of their income on energy, as they spend more time inside their home and are more sensitive to climate conditions (Sokolowski et al. 2020; Mashhoodi et al., 2019). In The Netherlands, pensioners are (compared to non-pensioners) more likely to live in bigger, older dwellings with a low energy label (Middelkoop et al., 2018). This illustrates how certain characteristics of energy poor households can reinforce each other (i.e., energy inefficient dwellings and being older both contribute to increased energy use), contributing to a more adverse living situation. Ultimately, looking at vulnerability among energy poor households allows to look beyond energy poverty as a mere payment problem and to also consider more complex and nuanced matters such as the quality of the housing stock and households' needs and capabilities (Bouzarovski, 2013).

2.2.4 Conclusion

All in all, research suggests that various socio-economic and housing characteristics are prevalent among energy poor households. These characteristics include having a low income, limited educational attainment, being women, dealing with disabilities and/or illness and having a migration background. Also, energy poor households often live in energy inefficient dwellings and, at least in the Netherlands, in social housing. There is some research indicating geographical patterns to energy poverty, but so far research is inconclusive. Finally, it should be mentioned that energy poor households do not constitute a particular group, but rather a diverse collection of households with various characteristics. More and more research is conducted on how different characteristics of energy poor households may interact and reinforce each other in ways that contribute to more adverse living situations. In this regard it is also important to mention that the studies summarized above are based on studies conducted before the current energy crisis. Research cannot keep up with the rapidly changing world (i.e., research is generally a slow process). Therefore we should not rule out the possibility that there are energy poor

households, or households vulnerable to energy poverty, not described with these findings.

2.3 Consequences of energy poverty

This section provides an overview of the issues that energy poor households are found to deal with in their daily lives due to their living situation. We focus on financial issues (section 2.2.1), health issues (section 2.2.2) and social issues (section 2.2.3).

2.3.1 Financial issues

Energy poor people generally have difficulties paying their energy bills, contributing to under-consumption of energy (e.g., not heating one's home or warm up one's food) and/or debt to the energy supplier, and debt in general (Anderson et al., 2012; Bartiaux et al., 2018; Butler & Sherriff, 2017; Curl & Kearns, 2017; Gibbons & Singler, 2008; Hernández, 2016; Liddell & Guiney, 2015; Middlemiss & Gillard, 2015; Welsch & Biermann, 2017; Willand et al., 2015). Studies show that energy poor households have different coping strategies to deal with these financial issues. Some deliberately incur debt (Gibbons & Singler, 2008; Liddell & Guiney, 2015; Middlemiss & Gillard, 2015), some carefully budget their energy to avoid high bills (Brunner et al., 2012; Middlemiss & Gillard, 2015), and some trade-off other costs such as costs on food, medical care, and transport (Anderson et al., 2012; Bartiaux et al., 2021; Brunner et al., 2012; Gibbons & Singler, 2008; Hernández, 2016). Although one can hypothesize about the consequences of these trade-offs (e.g., not being able to buy healthy food affects people general health), the consequences of these trade-offs among energy poor households are not well documented and research is mostly focused on the type of trade-offs households make (e.g., Snell et al., 2018).

2.3.2 Physical and mental health issues

Energy poor households often live in energy inefficient housing. As a consequence, these households deal with (extreme) cold or warmth, and various mould, damp and draft problems (Balfour & Allen, 2014). Although it is hard to distinguish cause and effect relationships regarding energy poverty (i.e., energy poverty involves the interplay between housing conditions, income and energy expenditures and the energy-related coping strategies; Hernández, 2016), energy inefficienct housing seems to be related to various negative health outcomes (Evans et al., 2000; Kose, 2019; Lacroix & Chaton, 2015; Hernández, 2016). For example, a report of the Marmot Review Team (2011) summarizes a range of health difficulties more likely experienced by households living in energy inefficient housing, such as cardiovascular disease, respiratory conditions, anxiety, depression and stress, and increased risk of influenza, pneumonia, asthma, arthritis, and accidents at home.

Furthermore, there seems a causal connection between energy poverty and winter mortality (i.e., the surplus number of deaths occurring during winter months compared to non-winter months). For example, a time series study of Healy (2003) shows that fuel poverty is a significant factor (among other factors) predicting winter deaths. Also Wilkinson et al., (2001) applied a time-series design and revealed that the association between low outdoor temperature and mortality was stronger in those living in cold homes compared with those living in warm homes. Moreover,

the Marmot Review Team (2011) estimated that 21.5% of all excess winter deaths can be attributed to the coldest quarter of housing.

Studies also show mental issues as a result of energy poverty. For example, a survey among energy poor households show that energy poor experience the (energy) bills as a burden and that 55% said that a cold home made them feel miserable (Anderson et al., 2012). Interviews illustrate that some feel hopeless because there seems no solution for their problems (Anderson et al., 2012). Another interview-study showed that energy insecurity comes with chronic stress and the experience of mental health triggers (e.g., one falls into a depression due to a setback; Hernández, 2016).

Researchers not only found illustrating stories concerning mental health, longitudinal studies also show a relationship between energy poverty and mental health. For example, energy poverty increases the likelihood of depression in parents over time (Mohan, 2021). Another longitudinal study investigating the provision of central heating and insulation among income deprived communities in Glasgow (UK) suggests that those who report greater frequency of financial difficulty also report worsening mental health over time (Curl & Kearns, 2017).

Qualitative interviews illustrate how energy-poor people are limited in certain capabilities in their daily life (e.g., regarding health and adequate nutrition) and how these restricted capabilities sometimes reinforce each other (Bartiaux et al., 2021). This is also illustrated by research showing that children with moderate energy insecurity had greater odds of household food insecurity, child food insecurity, hospitalization since birth, and caregiver report of child fair/poor health than children with energy security (Cook, et al., 2008).

Hence, these results imply that inefficient housing is associated with adverse health effects. These health effects might on the one hand be partly caused or strengthened by the stress energy poor households might experience due to difficulties paying their energy bills (Anderson et al., 2012), but on the other hand also by their restriction in capabilities since money can only be spend once (Bartiaux et al., 2021). This also symbolizes how energy poor households might end up in a vicious circle contributing to the worsening of their living situation.

Supplementary to the findings described above, Jessel et al. (2019) performed a literature review based on 162 energy poverty health studies published between 1990 and 2018. Based on their results they developed a conceptual model (see Figure 2), framing the predictors of energy insecurity (i.e., inability to adequately meet household energy needs) and its links with health outcomes. This model shows that the links between energy insecurity (i.e., energy poverty) are not straightforward, but include various pathways.

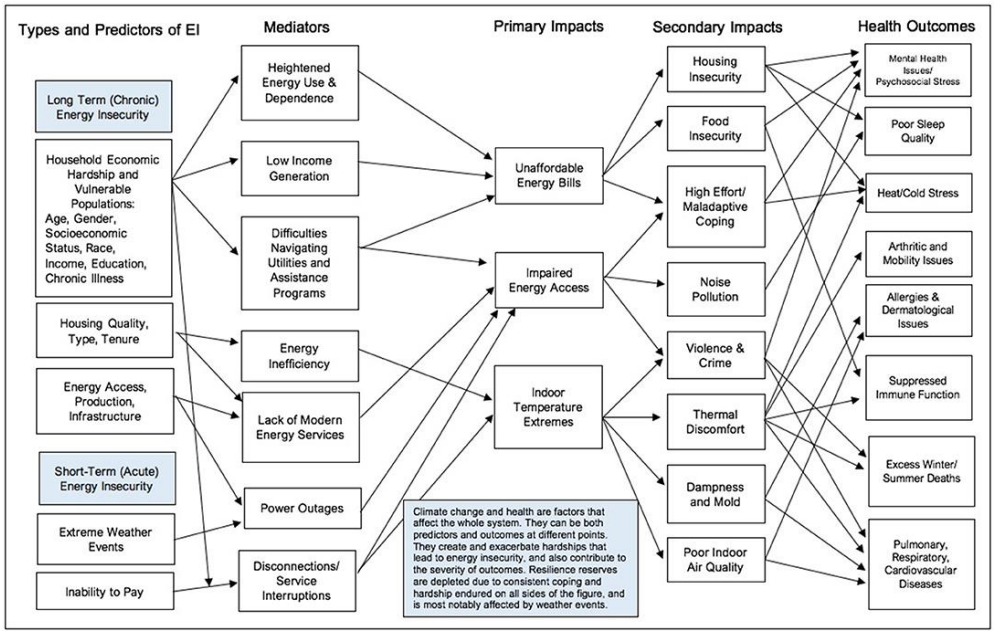

Figure 2. Connections between household energy insecurity (EI) and health outcomes (Jessel et al., 2019).

2.3.3 Social issues

A growing amount of evidence suggests that energy poor households experience negative effects on their social life, for example by inviting less people over to visit and by cutting back on leisure activities and holidays in order to save money (Bartiaux et al., 2021; Gibbons & Singler, 2008). Especially during winter time there are people who reduce their social life because their house is too cold to welcome friends and family which in turn can lead to loss of self-esteem and wellbeing (Anderson et al., 2012; Bartiaux et al., 2021; Gibbons & Singler, 2008; Middlemiss et al., 2019).

Another negative effect is that individuals *within* an energy poor household are found to experience poor relationships due to financial stress (Gibbons & Singler, 2008; Middlemiss et al., 2019). Besides, these households often have a poor relationship with key service providers (e.g., energy company, landlord) due to payment issues (Bartiaux et al., 2021; Middlemiss et al., 2019; Hernández, 2016).

2.3.4 Conclusion

Research suggests various adverse consequences of living in energy poverty. First of all, households living in energy poverty more often deal with financial issues than non-energy poor households. This is associated with debts and making trade-offs, since money can only be spent once. These trade-offs can lead to other consequences (e.g., ill health due to a lack of healthy food intake), but this area is not well studied yet. Research also shows various physical and mental health consequences presumably caused by living in an energy inefficient house. The relationship between housing characteristics and health outcomes may be partly caused and/or strengthened by (financial) stress and restrictions in households' capabilities (such as making trade-offs). In addition, living in a cold home can contribute to not welcoming guests, leading to other adverse consequences like low self-esteem and well-being.

Finally, it should be mentioned that because energy poverty is a multi-dimensional construct, it is often hard to distinguish cause and effect relationships. The above described findings illustrate several adverse consequences of living in energy poverty, but drawing solid causal conclusions would be presumptuous. Energy poverty describes the interplay between housing conditions, income, energy expenditures and energy-related coping strategies (Hernández, 2016), which all contribute to certain adverse consequences and some also reinforce each other (e.g., Anderson et al., 2012; Bartiaux et al., 2021; Brunner et al., 2012; Gibbons & Singler, 2008; Hernández, 2016).

2.4 What are energy poor households helped with?

Several interventions to support energy poor households have been researched. Below you will find an overview of studies evaluating the effects of two often applied measures: significant home improvements (i.e., large improvements, such as installation of central heating, renovations or insulation; section 2.3.1) and interventions that provide residents with small energy saving measures and advice (section 2.3.2).

2.4.1 Heat and energy efficiency improvements

A literature review of 28 studies (Thomson et al., 2013) shows that housing improvements (i.e., refurbishment, rehousing, relocation, installation of central heating and insulation) can improve residents' general health and alleviate respiratory symptoms. Improved health is most likely when the housing improvements are targeted at those with poor health and inadequate housing conditions, in particular inadequate warmth. A small number of studies also showed that warmth improvements were associated with increased usable space, increased privacy, and improved social relationships; absences from work or school due to illness were also reduced.

Another review (Liddell & Morris, 2010) of five large-scale studies on the effect of housing interventions shows that clinical health improvements (i.e., measurements with clinical instruments, such as a peak flow meter) could not be detected, but adults report an increase in perceptions of physical wellbeing. Additionally, mental health impacts emerged as surprisingly strong among both adults and adolescents. Also the physical health improvements of infants were more evident, especially in terms of infants' weight gain, hospital admission rates, and caregiver-rated developmental status. The authors argue these health effects to be more prominent in infants since infants spend more time indoors and are less likely to regulate their own temperature (i.e., by putting on warmer clothes or articulating a need for this).

Furthermore, the review of Liddell and Guiney (2015) about renovation effects on mental health and/or mental disorders also suggests that improvements to energy efficiency (i.e., heating and insulation improvements) are often associated with significant improvements in mental well-being. Their review showed improvement in mental well-being after energy efficiency improvement in 64% of the occasions. For tests of mental health 57% (8 of 14) were significant and for mental disorder 73% (8 of 11) were significant. These results suggest that efficiency improvements might be more evident for individuals dealing with mental disorders.

A meta-analysis of 36 studies by Maidment et al. (2014) presented that (on average) household energy efficiency interventions (such as improving insulation, heating and/or glazing) show a small but significant effect on (self-reported) physical and mental health. Their review also suggests that the effectiveness of home renovation may differ for different groups of participants. The health of residents with a low income improved significantly as a result of the interventions compared to residents with a high income, and significant health benefits were also identified for children in particular.

Another recent study investigated the effects of improving home heating on indoor climate satisfaction, finances and mental well-being (Sharpe et al., 2020). Results showed that the improvements in general increased indoor climate satisfaction and ability to pay the bills, but not in all cases. Also no clear effect on mental-wellbeing was found. The authors conclude that effects of improvements might differ due to differences in resident behaviours, lifestyles and housing characteristics. For example, people with (very) low incomes may still experience difficulties to pay their bill, causing them to still experience financial stress. Also, ventilation and heating patterns influenced indoor quality and comfort, emphasizing the importance of adequate behaviour practices. A longitudinal study of Curl and Kearns (2017) also suggested that negative effects on mental health might occur when recipients of central heating improvements are not aware of how they use this new system effectively.

Another study of Poortinga et al (2017) tested the implementation of different intervention measures in social housing, such as new windows and doors, boiler upgrades, cavity wall insulation and external wall insulation. It was found that these measures were associated with improvements in several social outcomes (i.e., housing suitability, satisfaction, and quality; thermal comfort and household finances), health outcomes (i.e., mental, respiratory and general health), and that the effect of the housing improvements seem to “add-up”: the more measures were applied, the better the outcomes. One exception was the cavity wall insulation, which led to poorer health outcomes (including respiratory health). This negative outcome is likely caused by the fact that no ventilation was installed, which is often needed to avoid damp with this type of insulation.

A recent longitudinal focus group study shows that, although improving the energy efficiency of homes at risk of fuel poverty amongst low-income communities has beneficial effects (i.e., on subjective wellbeing, quality of life, financial stress, thermal comfort, social interactions and indoor space use), the process of receiving the intervention was experienced by some as stressful (Grey et al., 2017). This is in line with other studies showing that renovations processes might have detrimental effects, at least on stress levels, nullifying the beneficial effects of a renovation or causing the beneficial effects some time to occur (Allen, 2010; Hickman et al., 2011).

2.4.1.1 Conclusion

In conclusion, studies on the effectiveness of heat and energy efficiency improvements show positive results: especially mental well-being seems to improve, though physical effects are also found. Results also suggest that positive outcomes are more evident when home improvements are targeted at residents with poor health and inadequate housing conditions. That being said, results also

suggest that improvements must be executed properly. For example, renovations can be experienced as very stressful, which implies that the process of renovating homes should be carefully planned, also in terms of support of- and communication with the residents. Also technical solutions must be selected carefully, because some come with negative outcomes (such as the presence of damp due to cavity wall insulation). Besides, for some technical solutions residents need clear instructions on the usage in order to prevent negative effects (e.g., increase in energy consumption). Hence, energy poor households are helped with home upgrades, provided that improvements are carefully executed and residents are supported through the process.

On a final note we observe that research into health effects of renovations has not been performed in the Netherlands. In order to find specifically vulnerable energy poor Dutch households it is pertinent that this type of research is conducted. This could help to make sure renovations can be executed for vulnerable Dutch households most in need of efficiency improvements. These results namely suggest that prioritising energy poor households when planning renovation efforts result in higher total health benefits than when energy poverty is not considered.

2.4.2 Receiving small energy saving measures and energy saving advice

Another often applied measure to help reduce financial burden of energy use is by installing small energy saving measures and giving energy saving advice to households. Few studies indicate or examined effectiveness of these measures.

Qualitative research by Walker et al. (2014) shows seven factors that increase energy-efficient behaviour among tenants: (1) knowledge and skills (e.g., how thermostat use can promote energy savings), (2) technical interventions (e.g., automatic on and off switching of the heating), (3) habits (e.g., shower habits or temperature setting), (4) external factors (e.g., arrival of a new family member), (5) quality of technical interventions (e.g., correct installation of double glazing), (6) convenience (e.g., switching off unused appliances) and (7) warmth comfort (e.g., quick showers because of cold in bathroom). This suggests that energy-saving advice and small energy-saving measures could reduce residents' energy consumption, as residents gain more knowledge and skills about energy-efficient behaviour and learn to break unsustainable habits.

Straver et al. *(*2017) analyse the effectiveness of five energy advice trajectories by looking at the interactions between energy advice givers (i.e., ‘energy coaches’) and receivers, and by measurements of realised or (if energy-usage data was not available) theoretical’ energy use. This ‘theoretical’ energy use was calculated based on energy saving practices reported by households that received energy advice (i.e., households were called for a telephone interview sometime after receiving advice). Results showed that households appreciated the advice and that applying energy saving advice (through changes in energy-related behaviour) and installing energy saving measures added up to savings ranging from 56 to 113 euros (*M* = 85 euros). The potential to save costs increased when energy coaches visited households more than once and when the coach is equipped with social as well as technical energy skills. It was also observed that energy use-patterns differ per household, meaning that not ‘one advice fits all’ and advice should be tailored according to the households’ needs.

In this Dutch study it was not examined whether households experienced less financial stress or other beneficial effects after receiving energy saving advice. But some other studies did. For example, research by Bashir et al. (2013) shows that advice on energy conservation and the application of small measures (such as boiler maintenance, repair of central heating and installation of draft-resistant doors) improved the perceived warmth and comfort of residents. In addition, residents reported feeling more in control of their indoor climate, which improved physical and mental well-being (such as less financial stress and fewer colds). However, the advice did not lead to a lower energy bill, which was explained by the rising energy prices during 2012-2013 in the UK and the fact that measures were sometimes implemented after the winter (i.e., when less energy is used anyway).

Another study, by Taylor et al. (2014), studied the effectiveness of energy audits among households. Their results showed that audits led to statistically significant energy savings, yet average savings varied widely, with the customers who performed best (i.e., most efficient) before the intervention saving the least energy and those who performed worst (i.e., least efficient) before the intervention saving the most.

2.4.2.1 Conclusion

Unfortunately, we found only a small number of studies that looked into the effects of energy saving advice and small energy saving measures among (energy) poor households (in the Netherlands[3]). One difficulty that is often encountered in this research area, which might contribute to the little research performed, is the difficulty to reach energy poor households (Maxim et al., 2016). Households living in energy poverty may experience feelings of shame or stigmatizing (e.g., Dubois, 2012), and may also be occupied with (financial) worries or everyday struggles (e.g., Mullainathan & Shafir, 2013). Although the studies summarized above suggest that energy saving advice and installing energy saving measures can contribute to changes in energy-related behaviour, saving energy costs and alleviating financial burden, there is too little evidence to draw solid conclusions. For households living in energy inefficient housing and households who already consume little energy[4], small measures and advice are presumably less effective. These households are better helped with renovation measures, which also improve health to a better extent.

[3] Recently a research project started in the Netherlands called ‘Just Prepare’. This project develops methodological and substantive knowledge on shaping an inclusive energy transition in underprivileged neighbourhoods. Solutions are developed in collaboration with municipalities, housing corporations, residents and other relevant actors. There are four pilot sites (‘Living Labs’), located in: Amsterdam Zuid-Oost, Gemert, Nijmegen-Kanaalzone en Rotterdam Bospolder-Tussendijken. The project started in 2022 and ends is 2026.

[4] In the Netherlands there are 140.000 households living in what is called *hidden* energy poverty (Mulder et al., 2021a).

3 Energy poverty policies and initiatives across Europe

Energy poverty entered the policy world in 2009 and since then various policy developments have occurred. This section describes the existing energy poverty policies on EU level, as well as national levels (section 3.1), and the policy measures put in place by the EU and different EU countries since the energy prices increased tremendously past two years (section 3.2). We chose to include European countries that are similar to the Dutch context (i.e., regarding socio-economic characteristics) and European countries that implement progressive energy poverty policies.

3.1 Energy poverty policies on EU and national level

3.1.1 Energy poverty policies on EU level

The term energy poverty first appeared on the EU policy agenda in 2009, when the third Energy Package[5] was introduced. At that time, the target of energy poverty policy was a 'vulnerable consumer' (see Box 2) and EU Member States had the exclusive right to determine their own policies and measures to protect so-called *vulnerable consumers* (Filippidou, 2019). This led to the absence of a unified definition on energy poverty and contributed to the inability to gain a clear picture of energy poverty at EU level[6].

Box 2. Vulnerable consumers and energy poverty

Although vulnerable consumers and energy poverty are linked concepts, they are not the same. Vulnerable consumers are in a disadvantageous position to purchase electricity and/or gas due to several reasons (e.g., age, income, disability etc.), making them in need for support to participate as consumer on the energy market. Vulnerable consumers may become energy poor if they would not be supported to participate in the energy market.

The concept of vulnerable consumers remains within the boundaries of the energy market and the affordability of energy, whereas the concept of energy poverty goes much further and underlines the importance of energy efficiency as well (Pye et al., 2015). These definitions and perspectives contribute to manner in which households are helped. Vulnerable consumers are usually best helped with short-term financial support limited to electricity and gas, while this is insufficient for energy poor households who are also in need of energy efficiency measures.

[5] This package included regulations for the functioning of internal market in gas and electricity. Some parts of this package are still in place. For more information see: Third energy package (europa.eu)

[6] Energy poverty measurements are not unified across the EU. The only measurement currently used is the EU-SILC, which measures energy poverty as the ability to keep the home adequately warm. This questionnaire can be found on: Questionnaires - Income and living conditions - Eurostat (europa.eu)

Over the last couple of years, the EU has increased its efforts to ensure safe and accessible energy for EU households and to prevent vulnerable households from being left behind in the energy transition. The introduction of the Clean Energy for All package was an important step in this development. This package, and other types of policies and as well as EU-funded initiatives are described below.

1. Clean Energy for All package

Launched in 2016, this package includes various directives related to energy poverty. They require EU Member States to…:

- …monitor and report the number of energy poor households to the European Commission[7].
- …prioritize energy poor households in energy efficiency measures and policy[8].
- …use a minimum share of their mandatory energy savings to alleviate energy poverty[9].
- …report about their progress in alleviating energy poverty[10].
- …report which energy savings are reached by their policies[11].

2. EC recommendation on energy poverty

Although not policy perse, this document is important as it covers the EC recommendation to Member States on how to define and monitor energy poverty[12]. It was published in October 2020.

3. Social Climate Fund

The social climate fund of €140 billion aims to enable a just transition and was introduced to limit the social impact of the new emissions trading system for the building and road transport sector[13]. The fund provides funding to Member States to support measures and investments in among others increased energy efficiency of buildings and granting improved access to zero- and low-emission mobility and transport. Pending the impact of those investments on reducing costs and emissions, the fund will also be able to finance temporary direct income support for vulnerable households. Please note that this is not a policy measure yet. This has long been a proposal, but only on December 18th, 2022, it was accepted by the EC. The next step is for the Member States to confirm this.

4. Examples of EU projects and initiatives on energy poverty

1) ENPOR: an EU project, funded by Horizon 2020, focusing specifically on energy poor households in the rented private sector. The project examines energy poverty policies in the EU focused on this specific target group, develops a monitor to measure energy poverty and supports the set-up of energy efficiency policies in this sector[14].
2) EnergyMeasures: an EU project that addresses energy poverty in seven European countries (BE, BG, IE, MK, NL, PL, UK) through household engagements and working with various relevant actors (e.g., municipality, housing associations) to assess how current multi-level institutional

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7 Electricity Directive ((EU) 2019/944), article 29
8 Energy Efficiency Directive (2012/27/EU) and amendment (2018/2002), article 7 (sub 11)
9 Energy Efficiency Directive (2012/27/EU), article 8 (sub 3)
10 Governance Regulation article 24
11 According to article 7 sub 11 (see above; Governance Regulation article 21 (sub c):)
12 For more information see: Recommendation (EU) 2020/1563 - Energy Poverty | Interreg Europe
13 More information on this ETS can be found on: Increasing the ambition of EU emissions trading (europa.eu)
14 For more information see: ENPOR at a glance • ENPOR

contexts affect efforts to alleviate energy vulnerability in the participating countries. The project started in 2020 and runs until March 2024[15].

3) Wellbased: an EU project that specifically focuses on alleviating health effects of energy poverty. The project started in 2021 and aims to identify effective measures to decrease health effects and support energy poor households. Support measures are tested in six European pilot cities: Heerlen (the Netherlands), Obuda (Hungary), Leeds (UK), Valencia (Spain), Edirne (Turkey) and Jelgava (Latvia)[16].
4) Affordable Housing Initiative: this initiative aims to stimulate the energy efficient renovation of social housing. One of the actions part of this initiative is the renovation 100 districts after which blueprints for replication are made available[17].
5) Energy Poverty Advisory Hub (EPAH): The EPAH is an online platform that aims to exchange knowledge and best practices regarding energy poverty. The website includes an online introduction training about energy poverty and a database with European examples of policies, (research) publications and organizations working on energy poverty. The EPAH was preceded by the Energy Poverty Observatory (EPOV). This project started in 2016 and lasted 40 months. It was aimed at stimulating knowledge and policy exchange in Europe.

3.1.2 Energy poverty policies on national levels

One might expect that introduction of European energy poverty policies and initiatives enable coherence across Member States and their policies. However, there were (and are) still differences between Member States. Also European countries in general differ in their policies. This is observed by Pye et al. (2015), who reviewed over 280 policy measures of European Member States. They identified that especially Member States that defined the concept of energy poverty have policy measures in place that not only target vulnerable households in general, but energy poor households as well. In contrast, Member States without established definitions, seem to lack specific energy poverty policies.

In the UK[18], energy poverty is commonly known as fuel poverty (Pye et al., 2015). The concept of energy poverty was first recognized in the Warm Homes and Energy Conservation Act 2000 (WHECA), which states that “a person is to be regarded as living ‘in fuel poverty’ if he is a member of a household living on a lower income in a home which cannot be kept warm at reasonable costs.”[19] Energy poverty was initially measured with the 10% measure (i.e., measures whether one spends more than 10% of its income on energy). Later on this measurement was supplemented with the Low Income High Cost indicator (i.e., energy costs above the median and residual income is below the official poverty line; LIHC) and the fuel poverty gap (i.e., the extent to which assessed energy needs of fuel poor households exceed the threshold for reasonable costs).

The UK not only has several financial policies in place to support fuel poor, but also set a target to improve the energy efficiency of energy poor households’ homes. By 2030 ‘as many fuel poor homes as is reasonably practicable achieve a minimum energy efficiency standard of Band C’. This target is monitored with the so-called

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15 For more information see: EnergyMeasures – Supporting energy vulnerable households
16 For more information see: Home | WELLBASED
17 For more information see: Affordable housing initiative (europa.eu)
18 At the time the analysis of Pye et al. (2015) was performed, the UK was still part of the EU. On January 31 2020 the UK left the EU.
19 See Warm Homes and Energy Conservation Act 2000 (legislation.gov.uk)

Fuel Poverty Energy Efficiency Rating (FPEER). In Scotland, ministers are obliged to present a strategy to reduce the number of energy poor households and a goal has been set that, in 2040, the number of energy poor households cannot exceed 5% of the total number of households[20].

Similar to the UK, Ireland has a tradition of tackling energy poverty as well. Although Ireland does not have an explicit definition of energy poverty, they recognize the issue and have a national energy poverty strategy (Kerr, Gillard, & Middlemiss, 2019; Soriano, Pellicer, Jordá, & Muñoz, 2021). On a national level, they are several energy- and social-oriented policies to support households, such as subsidies for building insulation, financial aid for energy bills and protection from disconnection (for an overview see Soriano et al., 2021).

France is at the forefront of energy poverty as well. France has an official definition of energy poverty that was introduced by law in 2010[21] and monitors the incidence with the so-called 'basket' of indicators (i.e., 10% measure, subjective experience of cold and an adapted LIHC measure; Kerr, Gillard, & Middlemiss, 2019). France addresses energy poverty through social policies (e.g., policies that support low-income households through energy bill support), as well as specific energy policies (e.g., social tariffs and the National Investment Plan for Housing[22]).

Although Belgium does not have an official definition of energy poverty, the country executes specific energy poverty policies on a national and regional level (Soriano et al., 2021). Belgium provides among others, social tariffs, subsidies for building insulation and heating installations. The institutional structure in Belgium presents a challenge in this regard, as social-oriented policies are a federal matter while energy-oriented policies are a regional matter (Bartiaux, 2020). As a consequence, subsidies aimed at, for example, energy-efficiency renovations may vary across regions. In general, the Belgium policy is centered around preventing disconnection from the energy grid.

In other countries, such as Sweden, Norway, Finland, the Netherlands and Germany, energy poverty is (still) not a distinct recognized concept with specific policies and targets. This contributes to the manner in which the issue is approached. These countries address energy poverty via the general poverty care system and primary measures are aimed at disconnection prevention (Pye et al., 2015; Soriano et al., 2021). Social beneficiaries receive financial support to cover their energy bill costs, however this leaves a significant group of households unaided (e.g., households that get into trouble specifically by their energy bill). In other ways this also affects policies. For example, The Netherlands has the National Insulation Program[23] in which energy poor households are mentioned, but not specifically addressed. This is because policy makers are, because of privacy laws, not able to use income data to grant subsidies to households. In addition, several studies by Filippidou et al. (2016; 2017; 2018) on the Dutch social housing

[20] For comparison, in 2021 the total number of energy poor households (defined as spending 10% of net income to energy services) was 24% (Energy Action Scotland, 2021). For more information on the Fuel Poverty Act see: Fuel poverty - Home energy and fuel poverty - gov.scot (www.gov.scot)

[21] See LOI n° 2010-788 du 12 juillet 2010 portant engagement national pour l'environnement (1) - Légifrance (legifrance.gouv.fr)

[22] This plan targets to renovate 50000 dwellings from vulnerable households per year.

[23] See also Nationaal Isolatieprogramma | Publicatie | Rijksoverheid.nl

stock indicate that many energy efficiency measures are implemented, but that they are too small to fulfill the goals of the national Covenant agreed in 2012 or reach the EU goals for energy efficiency.

3.2 Rising energy prices: policies gaining momentum across European countries

The energy prices increased significantly. The price increase already started in 2021 because of the economic recovery after the Covid pandemic, but energy prices received another impulse when Russia invaded Ukraine. To prevent the consumer energy costs from increasing further and to buffer the negative effects of high prices on (energy poor) households, the EU and EU countries implemented several acute policies, described below.

3.2.1 Recently proposed measures on EU level

The EC initiated several measures since the start of the energy crises. These measures are primarily aimed at supporting Member States in their help aimed at households and stimulating changes at the energy market to drive the price down, or guard further price increases:

1. Toolbox for tackling rising energy prices

In the fall of 2021 the Commission published a so-called 'toolbox' to help Member States support households and the industry. The toolbox lists short and medium term initiatives that Member States *can* (i.e., suggestions) and the Commission *will* (i.e., commitments) take[24].

2. Commission Energy Poverty and Vulnerable Consumers Coordination Group

In April 2022 the EU Commission established a coordination group to support EU countries in exchanging best practices and increasing coordination of energy poverty policy measures. The coordination group is chaired by a representative of DG ENER, a department of the Commission that is responsible for energy policy in the EU.

3. REPowerEU

In May 2022 the EC presented a plan to become independent of Russia's gas before 2030. The plan includes measures to save energy, produce clean energy and develop an energy supply consisting of several sustainable energy resources[25].

4. Save Gas for a Safe Winter Plan

In July 2022 the EC proposed a non-mandatory plan to reduce gas demand by Member States. The goal is to achieve 15% demand reduction for Member States between 1st August to 31st of March 2023 (compared to their previous five-year average consumption for the same period). When the EC announces a ' EU alert level' the target becomes mandatory[26].

5. EU emergency Intervention

In September 2022 the EC proposed additional measures, among others: a mandatory gas demand reduction of 5% in peak hours, a cap on market revenues

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[24] For a complete overview see: EUR-Lex - 52021DC0660 - EN - EUR-Lex (europa.eu)
[25] REPowerEU (europa.eu)
[26] See also Save Gas for a Safe Winter (europa.eu)

for inframarginal technologies that produce electricity, a solidarity levy for fossil fuel sector and several retail measures for medium-sized enterprises[27].

6. Energy Emergency: preparing, purchasing and protecting the EU together

In October 2022 the EC presented a regulation proposal that includes among others a voluntary joint purchasing of gas, energy solidarity measures in case of disruption in gas supply at national, regional or EU level, and a EU framework to cap the price of gas in electricity generation[28].

3.2.2 Recently proposed measures on national levels

To shield households and businesses from the rising energy prices, European countries have together spent €674 billion in the period from September 2021 to October 2022[29]. This paragraph provides an overview of the measures that multiple European countries have put in place in response to the rising energy prices. The measures are listed in Table 1 below. Please note that this (non-exhaustive) table only includes measures to support (low-income or energy poor) households. As measures aimed at businesses are not within the scope of this report, they are not included[30]. We chose to include European countries that are similar to the Dutch context (i.e., regarding socio-economic characteristics) and European countries that implement progressive energy poverty policies and are discussed in the previous section (see section 3.1).

Reflecting on the measures put in place, one immediately notices the significant direct financial support to households in support of paying their energy bills. There seem to be no specific differences in policy measures comparing the Netherlands to other EU countries (Table 1). It also seems apparent that, although there is support targeting 'vulnerable' or low-income households in specific, many measures target households in general. We observe two trade-offs in this regard: 1) reaching many households fast versus reaching households most in need of help slower, and 2) helping households on the short-term with their purchasing power versus helping households become resilient in the medium to long-term. Attention should be given to both. The measures summarized in Table 1 provide budget support to households on the short term, but energy prices will probably remain high for some time[31] and the amount of public resources involved will be so large that support is likely to decrease over time. Helping households in the long run would mean solving one of the underlying issues of energy poverty: the quality of the housing stock (see section 2).

As the European Commission's REPowerEU plan highlights, deployment of renewable energy resources is the only economic and environmentally sustainable option to overcome the high (fossil fuel) energy prices. This emphasizes the

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27 See also Emergency intervention to address high energy prices in the EU | Think Tank | European Parliament (europa.eu)

28 See also European Council conclusions on energy and economy, 20 October 2022 - Consilium (europa.eu)

29 For a complete cost breakdown see: National fiscal policy responses to the energy crisis (bruegel.org)

30 A complete overview of measures by European countries is prepared by Bruegel (i.e., European Economic think tank), see: National fiscal policy responses to the energy crisis (bruegel.org)

31 As part of the Dutch climate agreement, gas prices will increase over time, in order to make clean alternatives relatively more attractive.

necessity for measures aimed at improving the energy efficiency of the housing stock and investments to increase the share of renewables in the energy mix.

Obliviously, renovation measure take more time to implement than financial support. However, this does not mean there should be less attention for structural measures. To structurally help households, making homes more sustainable should receive more priority (Faaij et al., 2022). Recent research shows that renovating homes in Europe could save 44% of energy for heat (Building Performance Institute, 2023). The energy savings potential of the Netherlands is even estimated to be 57%. In Fitfor55 and The Green Deal long term renovation to combat energy poverty has a (central) place, which indicates on EU level this emphasis is growing.

Recently a study by Van Tilburg et al. (2022) was performed among Dutch policy implementers at the municipality (i.e., the municipality is responsible for implementing the Dutch policies summarized in the table below). Municipalities were surveyed about their experiences on current energy poverty policies. Respondents indicated a lack of a long term energy poverty strategy and policy measures in line with that strategy. This illustrates how both policy executors and research emphasizes the need for long term strategies.

Table 1. Measures adopted by European countries to help alleviate adverse consequences of rising energy prices.

Country	Measures announced and/or adopted from 2021-2022
Belgium	• Extension of the social energy tariff until at least March 2023. • Low-income households receive an €80 energy check that will be deducted from their bill. • To support households that are not eligible to receive the social tariff, a €16 million Fund for Gas is set up. • Taxes such as the federal contribution for gas and electricity and green power certificates are being replaced by excise taxes. This enables the government to easily compensate for high energy prices. • Prohibition of unilateral changes in energy contracts. This should prevent invoice increases, also for fixed price contracts. • Electricity VAT reduction from 21% to 6% until the end of 2022. Low-income households will receive further charge reductions. • Every household receives a €100 cheque. • Oil-heated households receive a payment of €200. • Government announced that banks would provide support for households most hit by energy prices through deferred mortgage payments and developing means to broaden access to energy savings measures.
Finland	• VAT electricity reduction from 24% to 10% between 1 January 2023 and 30 April 2023. – Low-income households that face a monthly electricity bill exceeding the deductible of €400 (to maximum €1500) will be entitled to a subsidy covering 60% of the bill between January 2023 and end of April 2023.

France	• €100 payment to households receiving energy vouchers. This measure was later extended to everyone earning less than €2000 per month. • 4% price cap increase on electricity and freeze of gas prices until end of 2022. This package will be renewed in 2023 and includes capping the increase in gas and electricity prices at 15% (i.e., average increase limit in bills of around €25 per month for households heating with gas and around € 20 per month for households heating with electricity). People heating with oil or wood receive support up to € 200. • Reduced electricity tax €22.50 per megawatt hour to €1 for household. • Mid 2022 the government announced a takeover bid of €9.7 billion to nationalize the main French electricity supplier (EDF). • €230 million support package for, among others, households using oil heating. • Relief package including a 4% increase to people on welfare, pension and disability benefits. • Energy Sobriety plan: providing (among others) financial support to households changing heating systems and financial incentives to stimulate lower energy consumption of households. The plan aims to reduce energy consumption over the next two years by 10% compared to 2019.
Germany	• In January 2022 there was a reduction of the levy on electricity (“Erneuerbare-Energien-Gesetz”) from 6.5 to 3.72 cents on the wholesale price per kilowatt-hour. In April 2022 it was decided to eliminate the EEG. • €130 million is allocated to financially support low-income households: – Increased commuter allowance – €135 for students and vulnerable citizens. Later announced measures added €200 for university students and €300 for pensioners. – Income tax reductions. – Increased payments for poor children (extra €20/month per child). – €100 subsidy to unemployed people. • One-time payment of €300 for every taxpayer. • €100 cheque to boost child support. • Increase of welfare payments by €500. • Cover one month’s gas bill in December and, starting in Spring, subsidising 80% of the normal September consumption at €0.12 per KWh. Total funding (including measures to shield businesses): €85 billion

Ireland	• 30% tax rebate on vouched expenses for heat and electricity. • €202 million for dwelling renovations. More than half of the funding is allocated for free upgrades for low-income households. • Low-cost loan for residential retrofitting. • Initially all domestic electricity customers received €100, this payment was later raised to €200.
Netherlands	• Total of €300 million for municipalities to support energy poor households (first €150 million was announced in 2021). – Energy poor households as defined in TNO study with Low Income High Costs and Low Income Low Energy Efficiency Home (Mulder et al., 2021a) • Lowering of the energy tax on electricity • Energy tax refund increased from €560 to €785. • Increase of the energy surcharge to €1300 for welfare recipients and people earning less than 120% of the social minimum (earlier measures announced an increase of €200 and €800). This increase is also disbursed in 2023. • Lowering of the energy VAT from 21% to 9% (natural gas, electricity and city heating). • 10% increase of the minimage wage. • Price cap starting in January 2023: 40 cent/KWh and €1.45 m^3 gas, for a use below 2900 kilowatts hours and 1200 m^3 gas. Households using more electricity and/or gas pay the higher electricity price. • All households receive €190 in November and December to bridge the months before the price will be active.
Norway	• January 2022 it was announced that the government will pay 80% of the portion of power bills above prices of 0.70 krone per KWh. – In September 2022 this percentage was increased to 90%. • Increased housing support. • Grants to municipalities to cover increased social assistance payments. • Reduction of the electricity charge in the winter months.
Sweden	• Households who consume more than 2,000 kWh per month (that amounts to 1.8 million households) will receive compensation of €195 a month for December, January and February. • Temporary increase in housing allowance for families with children from July to December 2022 (25 per cent of the preliminary housing allowance, with a maximum of €128 per month). • Sweden's national power grid operator argued that the government should compensate consumers with electricity costs more than 0.75 crowns per kilowatt hour (€0.069/KWh).

UK	• £500 million fund to help most vulnerable people pay their energy bills (and food and clothing expenses). • Warm Home Discount schema: medium and large energy suppliers support energy poor households and households at risk of energy poverty. • Winter Fuel Payment: allowance between £100 and £300 to help households pay their heating bills. • All energy account holders get £400 off their energy bill coming winter. • Households on particular benefits (income poor) will receive a further £650. – Pensioners get a further £300. – Disabled people get a further £150. • Households living in homes valued in Council Tax bands A to D receive a £150 tax rebate. • Energy price freeze at £2,500 for the average household.

4 Conclusion

There is a risk that the energy transition and the energy crisis make it increasingly difficult to realise affordable, safe, sustainable and sufficient energy for all. This is worrisome for those households that are directly affected, but it also poses a threat for the energy transition because increasing societal inequalities can undermine the general public support for the energy transition. This report is part of the Dutch national research program on energy poverty which aims to support local, regional and national policy makers and implementers with up-to-date and focused knowledge on energy poverty. Therefore the report provided an overview of energy poverty science and energy poverty policies.

In the sections below we aim to summarize the most important issues in the state of play by describing what research tells us about energy poverty and what could be addressed by future research (section 4.1), and by describing what energy poverty policies can learn from research and what the Netherlands can learn from other European countries (section 4.2).

4.1 What does research tell us and what could be addressed by future research?

Energy poor households share some common characteristics, but diversity should not be overlooked

Research findings show several characteristics that are profound among energy poor households, such as having a low income and living in energy inefficient housing. Although some characteristics are prevalent, energy poor households still constitute a diverse collection of households. This variety of characteristics, and also the recent introduction of intersectionality in energy poverty research, emphasizes that energy poor households might have different needs to help improve their living situations. This is in line with results of studies into effectiveness of energy poverty measures to support energy poor households. Research into effects of receiving energy saving advice for example shows that households have different energy patterns and are therefore in need of tailored energy advice.

Energy efficiency improvements and small energy saving measures should be deployed for different purposes

The effects of energy efficiency home improvements differ per target group, but overall they have the potential to improve mental and physical well-being of households, and beneficial effects become more likely the more renovation measures are adopted (i.e., effect of renovation measures seem to add up). Receiving energy saving advice or small energy saving measures primarily have the potential to reduce energy use and costs (among other because of energy-efficient behaviours). Also they seem to enhance a sense of control, which in turn may contribute to improved mental health. However, the effects of these type of measures also seem to differ per target group. Households who already consume little energy are for example less helped. Also households in poor quality housing are probably better helped with renovation measures. This illustrates how different households may be best helped with different type of measures, or a combination of measures.

Large scale Dutch research into support measures and their effect on energy poverty alleviation is desirable

Measures to support (energy poor) households have gained an impulse due to the energy crisis, meaning that currently several measures are implemented on a large scale. Effects of these support measures are however little studied, we observe particularly few Dutch studies on this topic. It is important to gain detailed and specific insight in the characteristics of different Dutch energy poor households and the measures they are helped with, as this will help to tailor support measures to alleviate the adverse consequences of energy poverty. In addition, we observe that current research (both into efficiency improvements and receiving advice or small energy saving measures) mostly focuses on outcomes such as mental and physical health and financial stress or energy use. However, we did not find studies that measured the extent to which measures enables households to escape energy poverty. In order to structurally help households and make households more resilient, it is preferable to gain insight in measures that lower the risk that households will be confronted with energy poverty in the future.

Point of interest: energy poverty research may benefit from a combination of research methods

One way to address future research is to combine quantitative research methods (i.e., research with numerical data, such as survey data) with qualitative research methods (i.e., research with textual data, such as interviews or focus groups) and other methods that require more active participation of the target group (e.g, participatory action research; Kindon, Pain, & Kesby, 2008). Whereas surveys might help to gain insight in a large population of energy poor households (i.e., surveys require less time from a researcher), they give less in-depth understanding of target group experiences. In contrast, qualitative research methods (like interviews or focus groups) are more time intensive but allow for more profound insight into experiences of energy poor households. Both research methods complement each other, and might be relevant in order retrieve a deeper understanding on how and to what extent certain measures support energy poor households. Not only will this contribute to more effective policies, it will also contribute to better supported policies. Research from TNO (Klösters et al., 2022) and TU Delft (Mouter et al., 2021) shows that (Dutch) citizens favor climate policies that take into account the vulnerability of low-income households.

Point of interest: hard-to-reach target groups require additional attention

One difficulty that was shortly mentioned earlier in this report is the difficulty to reach energy poor households. Reaching the target group is obviously a crucial requirement in order for support measures to be effective. There is more and more research emphasizing the role of stress in everyday functioning of (energy) poor households (e.g., Mullainathan & Shafir, 2013). Stress might play an important role in the vicious circle of energy poor households, contributing to difficulties households may experience in accessing available subsidies or support measures, but also for providers of help to reach households (i.e., households are too busy with their daily challenges). It is therefore desirable to gain insight in ways to break this vicious cycle and to identify ways in which these groups can be successfully reached.

4.2 What can we learn from science and other European countries?

Looking at both the policy and research state of play allows to gain insight in the extent to which energy poverty policies match energy poverty research findings (i.e., are policies in line with evidence-based practices?). In addition, looking beyond the Dutch borders gives insight in what can be learned from existing energy poverty policies in other European countries.

Tackling energy poverty requires energy poverty policies
Energy poverty is not the same as general poverty. As described in this report, energy poverty describes the interplay between low income, poor housing conditions and high energy bills. Since there are non-poor households living in financial difficulties specifically because of their energy bills and there are poor (i.e., low-income) households who do not have difficulty paying their energy bill, it is evident that energy poor households are not (sufficiently) helped with policies following from the general poverty care system (i.e., financial support targets only one of the energy poverty dimensions; affordability of energy). There are several countries that take this into account and have developed specific energy poverty policies (e.g., Ireland, France). An analysis in Ireland shows that energy poverty policies can be very fruitful (Scheer, 2013). Each euro that is invested in enhancing the energy efficiency of energy poor households' home yields 2,5 euros of societal benefits, due to lower energy use, increased health and lower health care costs and emission reductions. Although this is not a Dutch analysis, it illustrates the potential of energy poverty policies.

Supplementing recent financial support measures with structural solutions
Many policies implemented during the energy crisis, whether in the Netherlands or in other countries, focus on financial compensation. The attempt to alleviate high energy price effects on households by financial support targets the income tenets of energy poverty in the Boardman framework (Boardman, 1999). Seeing the urgency of the current vulnerability of (energy) poor households and the difficulty in speeding up insulation of homes of the energy poor households, the additional current measures are a logical means of support. However, the question remains if this is sufficient. As research sheds light on the dynamics and interdependencies of energy poverty, it is likely that the current measures are not specific and strong enough to help households facing the effects of energy poverty. Also, the amount of public resources involved will be so large that support is likely to decrease over time. To structurally help households they should be helped towards sustainable homes in a more urgent or prominent matter.

Energy poverty indicators help to develop and steer policy
Related to the point above, it is important to mention that there is no (or less) possibility to create specific energy poverty policies without official energy poverty indicators. Only the United Kingdom (including Scotland), France, Cyprus and Ireland initiated specific policies to monitor and report the number of energy poor households to the European Commission. Without specific energy poverty policies and vision about who to compensate and prioritizing renovating homes, only general policies and help can be provided for Dutch energy poor households. Help that is not tailored to the specific target group is inherently less effective, as it is likely not to fit the specific needs of the target group. As described in previous chapters, more policies and regulations stemming from the EU will also make it

necessary for the Netherlands to indicate, measure and tackle energy poverty. The Energy Performance of Buildings Directive (EPBD)[32], several EED's and the Fit for 55 packages are examples of this trend.

Point of interest: citizens are gaining an ever bigger role in the policy landscape

Finally, it should be recognized that the role of households in the energy system will become more important and prominent. They will not only be consumers of energy, but producers and prosumers as well (Annala et al., 2021). Also citizen energy communities will take a more prominent place in current and future energy services, products and systems. This development is currently little reflected in energy policies, especially how energy poor households can play a more active role in these communities or the energy system in general. Although the EU is paying attention to this, among others by emphasizing that renewable energy (projects) should be accessible for vulnerable households (see directive 2018/2001[33]), it is up to nations themselves to put this into practice. Currently local governments such as municipalities often take up this task, but they indicate a need for national guidelines (see e.g. Van Tilburg et al., 2022).

[32] Legislative framework that aims to stimulate the energy performance of buildings. For more information see Energy performance of buildings directive (europa.eu)

[33] More information can be found on EUR-Lex - 32018L2001 - EN - EUR-Lex (europa.eu)

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