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Role of New Metrics

ENERGY EFFICIENCY, THE OVERLOOKED CLIMATE EMERGENCY SOLUTION

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Abstract
Policies, especially in the European Union, encourage government and privately funded programs to engage in "energy efficiency first" strategies. Those policies lead to the moderation of energy demand and are long-term solutions that not only protect households from price fluctuations and energy poverty, but also allow people to reduce their environmental footprint and save money in the long term. Energy poverty usually occurs when a household is unable to secure a level and quality of domestic energy services—space cooling and heating, cooking, appliances, information technology etc.—sufficient for its social and material needs. In the Global North, energy poverty is generally attributed to internal and external factors such as low incomes, energy-inefficient homes and high energy prices, while in the Global South, the infrastructural lack of access to more technologically advanced energy carriers is the main culprit. Energy poverty in developing countries is gaining interest thanks to the seventh Sustainable Development Goal: Affordable and clean energy. Still, so far, in the European Union and in the rest of the world, little has been done to sew together the two concepts and include the most vulnerable part of the population in an approach that reconciles environmental and climate risks with social issues. In practice, energy poverty and efficiency agendas are rarely coordinated. Energy efficiency and a better pooling of the resources (known also as "sufficiency") could lead to higher resiliency to the social and climate crisis.
Keywords: energy poverty, energy efficiency, Sustainable Development Goals.
JEL: Q56, Q49.

Introduction

More than 1 billion people across the world, about 13% of the global inhabitants, suffer from some form of energy poverty. About a quarter of humanity lives without electricity or other modern forms of energy, while a third of the world population relies, at least partially, on traditional and polluting sources of fuel, such as kerosene, cow dung or firewood, at significant cost to their health, security, and economic welfare [Halff et al., 2014]. By one recent estimate, current patterns of energy production and consumption create as much as $22.8 billion in various health costs for the global economy. This is about 7.6% of the global gross domestic product (GDP) [Jacobson et al., 2017]. In the European Union, more than 50 million people, about 10% of that population, are unable to keep their homes adequately warm, are behind in payments, and live in poor housing conditions, while "summer" energy poverty is currently being overlooked.

Energy poverty occurs when a household is unable to secure a level and quality of domestic energy services—space cooling and heating, cooking, appliances, information technology etc.—sufficient for its social and material needs. This broad definition lies at the tip of a vast scientific and policy iceberg, involving complex sociotechnical contexts and situations [Bouzarovski, 2018]. The debate and regulations around energy poverty at the European Union and Member States' level focus primarily on the lack of a standard definition or a shared term. There is still an open debate about the right word to use: "fuel poverty" or "energy poverty". In this paper, the two terms are used interchangeably, consistent with official documents of the European Union.

The scale and nature of the fuel poverty problem change dramatically with different definitions and chosen thresholds. The definition is an essential tool to identify the policy mix, for administrative purposes, and for the allocation of resources required. Indicators measure the extent of the phenomenon and the policies to implement. In Europe, there are currently no common benchmarks, making it hard to accurately quantify the event at a larger scale. The selection of common European indicators is one of the tasks of the European Energy Poverty Observatory, launched in 2017. The recently adopted Clean Energy Package set of directives (as part of the Energy Union) is now calling for EU Member States to adopt a definition—taking into account the three causes of energy poverty: low income, high energy expenditures, and poor energy efficiency. In this case, "energy efficiency" is understood as the ratio of the output of performance, service, goods or energy to the input of energy.

The European Commission considers energy efficiency as one of the strategic priorities for the Energy Union and promotes "energy efficiency first" as a principle. It aims to rethink energy efficiency funda-

mentally and treat it as an energy source in its own right. By using energy more efficiently, energy demand can be reduced, leading to lower energy bills for consumers, lower emissions of greenhouse gases and other pollutants, reduced need for energy infrastructure, and increased energy security through a reduction of imports. Worldwide, energy efficiency is contributing to substantial savings in energy consumption[1]. The International Energy Agency (IEA) has found that "energy efficiency retrofits in buildings (e.g. insulation retrofits and weatherisation programmes) create conditions that support improved occupant health and well-being, particularly among vulnerable groups such as children, the elderly and those with pre-existing illnesses. Several studies that quantified total outcomes found benefit-cost ratios as high as 4:1 when health and well-being impacts were included, with health benefits representing up to 75% of overall benefits. Improved mental health (reduced chronic stress and depression) has, in some cases, been seen to represent as much as half of total health benefits"[2].

In parallel to the alleviation of poverty, the biggest global challenge is the climate crisis, tackled in particular through the transition to cleaner energy sources. In 2015, the Paris Agreement became the first universal and legally binding deal on climate change. However, the transition to more sustainable, sufficient and more efficient economies must be accompanied by adequate measures to help the most vulnerable in order to be fair and accepted by everyone. The French Yellow Vest movement in 2018 or the Bulgarian protests in 2013 are critical reminders that carbon reduction objectives are generally financed by taxes on household energy consumption, which weigh on all consumers, including those in vulnerable energy circumstances [Bennis, Mettetal, 2019].

Indeed, policies, especially in the European context, encourage government and privately funded programs to engage in "energy efficiency first" strategies. Policies leading to the moderation of energy demand are long-term solutions that not only protect households from price fluctuations and energy poverty, but also allow people to reduce their environmental footprint and save money in the long term. Still, we will see that so far, in the European Union, and the world, little has been done to sew together the two concepts and include the most vulnerable part of the population in an approach that reconciles environmental and climate risks with social issues. We will see in the first part of this article that energy poverty and efficiency agendas are, in practice, rarely coordinated. In the second part, we will concentrate on the delicate balance between resources and vulnerability and argue that energy effi-

[1] Understanding Energy Efficiency. European Parliament, 2015. http://www.europarl.europa.eu/RegData/etudes/BRIE/2015/568361/EPRS_BRI(2015)568361_EN.pdf.

[2] Health and Well-Being, IEA. https://www.iea.org/topics/energyefficiency/multiplebenefits/health-and-well-being-.html.

ciency and a better pooling of the resources (also known as sufficiency[3]) could lead to higher resiliency to the social and climate crisis.

1. Energy Poverty Is a Complex and Poorly Recognized Phenomenon. The Answers Provided Are Too Fragmented

Energy poverty is a complex issue, caused by numerous technical, political, environmental, socioeconomic, and personal factors. In the Global North, energy poverty is generally attributed to internal and external factors such as low incomes, energy-inefficient homes and high energy prices; while in the Global South, the infrastructural lack of access to more technologically advanced energy carriers is seen as the main culprit [Bouzarovski, Petrova, 2015]. Energy poverty in developing countries is gaining interest thanks to global initiatives such as Sustainable Energy for All (SEforALL), aimed at "reducing the carbon intensity of energy while making it available to everyone on the planet" so as to contribute to a "cleaner, just and prosperous world for all" [Bouzarovski, 2018]. This follows the seventh Sustainable Development Goal: Affordable and clean energy[4]. However, if Europe claims to be leading the way, there is still much to be done before engaging its Member States and the rest of the world in resilient and integrated strategies.

2. Despite the "Energy Efficiency First" Principle, the European Union Rarely Sees It Implemented in Practice

More than 50 million European citizens are unable to keep their homes adequately warm. The presence of structural problems within dwellings is quite common in the European Union, with, on average, 12% of EU residents reporting dampness or leaks in walls and roofs, and 9% living in accommodation with rot in windows, doors, or floors[5]. The post-war needs for rapid construction gave secondary importance to the quality and energy efficiency of buildings, leaving to younger generations a broken building stock. Structural problems are, on average, most common in Cyprus, where 51% of dwellings have a structural deficiency, but least common in Austria and Sweden, where 92% of residents reported no problems. Living conditions are deteriorating as the building stock gets older and does not undergo proper maintenance [Anagnostopoulos, De Groote, 2016].

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[3] Energy sufficiency describes the situation where everyone has access to all the energy services they need and a fair share of the energy services they want whilst, at the same time, the impacts of the energy system do not exceed environmental limits. https://www.energysufficiency.org/about/undersida/.

[4] Sustainable Development Goals, UNPD. https://www.undp.org/content/undp/en/home/sustainable-development-goals.html.

[5] Inadequate Housing in Europe: Costs and Consequences. Luxembourg, Eurofound, Publications Office of the European Union, 2016.

In parallel, around 90% of city dwellers in Europe are exposed to pollutants at concentrations higher than the air quality levels deemed harmful to health. Burning fossil fuels to generate electricity and to supply industry, households and transports is one of the leading causes of air pollution. Several of the most polluted European cities are in South-East Europe. Due to their low purchasing power, many inhabitants continue to use wood and coal as a source of heating. Low efficiency of the buildings and, in many cases, limited access to modern energy services aggravate the problem.

Poor health can be seen as a consequence of energy poverty, in general, as fuel-poor households live in colder homes and are potentially unable to afford or choose between other necessities (clothes and food mostly; communications and transportation, too), and may be unable to pay for medical services. All of this can exacerbate poor health and worsen long-term illnesses[6].

3. Recent and Fragile Policy Requirements

Despite having energy at their core (European Coal and Steel Community Treaty, 1951; and European Atomic Energy Community Treaty, 1957), the first overarching European energy policies emerged only in the 1990s, without any reference to energy vulnerability or energy poverty. It was not until 2006 that energy poverty was introduced as an EU issue by the European Commission, the "government" of Europe [Bouzarovski, 2018].

The second primary source of energy poverty policy has been the EU legislative framework on energy efficiency. Two other overarching frameworks that have guided EU energy policy are the Europe 20–20–20 Strategy and the Energy Roadmap 2050. In 2007, in its 10-year strategy for smart, sustainable and inclusive growth Europe 2020[7], the European Union set the objectives of reducing greenhouse gas emissions by 20% compared with 1990 (now 40% by 2030 compared with 1990 levels), increasing efficiency by 20% (now 32.5% by 2030), and getting 20% of EU energy from renewable sources in 2020 (now 32% by 2030). The Energy Roadmap also aims to reduce EU emissions by 80% by 2050 via a program of decarbonization. In a communication produced by the European Commission in 2011, it was stated that "vulnerable consumers are best protected from energy poverty through a full implementation by Member States of the existing EU energy legislation and use of innovative energy efficiency solutions", while emphasizing that "the social aspects of energy pricing should be reflected in the energy policy of

[6] Energy Poverty in Europe: How Energy Efficiency and Renewables Can Help. Council of Europe Development Bank, 2019. https://coebank.org/media/documents/CEB_Study_Energy_Poverty_in_Europe.pdf

[7] Climate & Energy Package. European Commission, 2020 https://ec.europa.eu/clima/policies/strategies/2020_en.

Member States" since "energy poverty is one of the sources of poverty in Europe". In the meantime, questions related to energy poverty mostly come from an EU-funded program (EPEE from 2006 to 2009) and also from the Council of Europe (2006), the European Court of Human Rights, and case law under the Revised European Social Charter.

In recent years, the EU has shifted from a timid requirement for Member States to protect "vulnerable consumers" (Third Energy Package, 2009) to a better acknowledgement and monitoring requirements of energy poverty. With the Clean Energy Package (2018–2019), EU Member States have to adopt a definition of energy poverty taking into account the income levels, the share of energy expenditure of disposable income, the energy efficiency of homes, and critical dependency on electrically powered equipment for health reasons, age or other criteria. Member States must monitor the phenomenon and propose appropriate measures. The elements included in the definitions will have an incidence at the political level, allowing specific categories of people to be more protected than others and to use different budgetary lines. Still, without integrated national and regional plans, it will be impossible to find large-scale responses to personal crises.

4. An Urgent Need to Renovate the Housing Stock

Energy efficiency policies for economic goods are one of the successes of the EU (for instance, the Ecodesign Directive in 2009 as well as Energy Labelling Regulations in 2010 and 2017 had an impact on dozens of appliances and electronics). However, despite solid efficiency progress, because of the growth in the number of households and tertiary areas, the proliferation of products and gadgets, the inflation in sizes and functionalities, longer usage hours, and rebound effects, the concept of sufficiency and an overall reduction of demand have been challenged[8].

The Energy Efficiency Directive (2012/27/EU) identified the existing building stock as "the single biggest potential sector for energy savings … crucial to achieving the Union objective of reducing greenhouse gas emissions by 80–95% by 2050 compared to 1990". Buildings account for 40% of the EU's energy consumption, 36% of its CO_2 emissions, and 55% of its electricity consumption, making emissions and energy savings in this sector vital to meeting the EU climate and energy targets. Almost 50% of the Union's final energy consumption is used for heating and cooling, of which 80% is used in buildings[9]. The achievement of the EU's energy and climate goals following the 2015 Paris Agreement

[8] Energy Sufficiency in Products. ECEEE, 2018. https://www.energysufficiency.org/static/media/uploads/site-8/library/papers/sufficiency-products-final__181108.pdf.

[9] The buildings sector covers the residential, commercial, public and services sectors; emissions from construction are accounted for in the industry sector.

is linked to its efforts to renovate its building stock by giving priority to energy efficiency, and the deployment of renewable energy.

With the slow addition of new buildings to the existing building stock, renovation to improve the energy efficiency of the current stock of buildings is imperative to meet the EU's targets of a 32.5% improvement in energy efficiency by 2030. Renovation appears as an essential way to tackle fuel poverty. To date, renovation rates in the EU are still low, and renovating the existing building stock to make it more energy-efficient remains a challenge—even more so when considering the ambitious levels set by the Energy Performance of Buildings Directive (EPBD 2010, recast in 2018), which includes aims for nearly zero-energy buildings (NZEBs) [Artola et al., 2016]. Member States should target actions in the direction of energy-poor consumers and social housing, in particular, through appropriate financing, while taking into consideration affordability. They have to set up short-term (2030), mid-term (2040) and long-term (2050) objectives to increase the rate at which existing buildings get renovated. According to the European Commission's impact assessment, in order to accomplish the European Union's energy efficiency ambitions cost-effectively, the renovation should reach an average yearly rate of 3%.

The UK Department of Energy & Climate Change (DECC) estimates of the savings associated with the different energy efficiency measures vary by year and by household characteristics, and are adjusted for comfort taking (i.e. direct rebound effects). Results from the latest assessment (DECC, 2014) indicate that low-income households, which typically spend a more significant share of their expenditure on energy, tend to see the most substantial reductions in bills as a proportion of total spending: the poorest 30% are expected to benefit from a reduction of between 0.6% and 1.6% of total expenditure, compared with a decrease of between 0.2% and 0.5% for other deciles. In addition to the financial impact contributing to poverty alleviation, energy efficiency retrofits or moving into new, energy-efficient buildings may hold another potential social benefit related to the improved social integration of underprivileged households by reducing social isolation caused by feelings of embarrassment regarding one's living conditions [Politt et al., 2017].

5. The Fragmented Landscape of Responses to Energy Poverty

In Europe, three types of policies are implemented to combat energy poverty, countries that have not adopted a definition or made it a public problem not being an exception [Bennis, Mettetal, 2019]: those are market regulation policies, social policies, and renovation and retrofitting plans.

Market regulation policies translate into measures to control prices and suppose constant and costly adaptation to the market. Under the pretext

of containing costs, despite numerous agreements at the European Union level to liberalize the energy markets fully, some countries continue to curtail market-opening actions, often to the detriment of alternative business models and renewable energy sources [Pepermans, 2019].

6. A Case Study in Belgium: The Papillon Project

The Papillon project started in 2018, led by the association Samenlevingsopbouw West-Vlaanderen. In Flanders, people who cannot sign an energy contract on the open market, because of unpaid bills and accumulated debts, are transferred to the safety net supplier, and end up paying a higher energy tariff. In general, those people have high energy use because of old appliances, and thus they also have high energy bills (high use x high tariff). Because of their debts, they do not have the budget to invest in new energy-saving appliances.

Samenlevingsopbouw West-Vlaanderen rents 100 household appliances to people with energy debts and old energy-consuming appliances in the house. People can rent new devices instead of buying new ones (refrigerators, freezers and their variants, washing machines, dryers and dishwashers, all from the Bosch brand).

The local public social welfare centers in the Westhoek region are critical partners in the project: they identify the households in need and engage them in the project. They are also acknowledged stakeholders in the Flemish energy poverty policy.

The Papillon project has the explicit intention to fight against energy poverty through the principles of circular economy. The leases, in which the service and warranty are included, run for 10 years. Each month, each family pays about 7 euros per appliance. Once a year, Samenlevingsopbouw transfers the collected rental money to BSH Home Appliances, which remains the owner of the devices. After the rental period, the appliances return to Bosch for reuse or recycling.

With this first experiment, Bosch wants to gain experience in the field of circular economy. When designing new appliances, it can then take into account, among other things, the reduction of waste stock and sustainable repairs. After a learning phase of 2 years, this project wants to spread to the rest of Flanders. In the meantime, there is contact with various European cities that are also interested in applying this model.

"Someone living in poverty fears unexpected bills", says Stefan Goemaere, in charge of the project. "We first prove to them that their old appliances are energy-intensive and cost them too much by placing small energy meters. Then our calculating engine shows that our model is cheaper than either buying a new appliance or using the old one. Our model includes the maintenance and the guarantee for 10 years. So if by any unlucky chance their appliance needs fixing, everything is included, at no extra costs".

Social policies usually take the form of income support or bill payment, special energy prices, social tariffs, bonuses, and benefits to cover energy costs (such as those in Belgium, Spain and Italy). They are intended to compensate for excessively high retail prices. The price and price-setting of energy are particularly relevant indicators of energy poverty, including whether prices are regulated or competitive, the levels of taxation, and the costs of supply. Curative measures of redistribution policies are prevalent in Europe, but they rarely target the energy poor and do not allow beneficiaries to leave their precarious situation sustainably and efficiently. They are limited by their long-term impact on energy efficiency and the mitigation of energy poverty, and they may even undermine public health and environmental protection objectives. For instance, in Bulgaria, despite figures suggesting a very high number of people affected by energy poverty, the primary tool is a heating allowance to help specific categories cope with expenditures. Even so, the purchasing power of the beneficiaries is often so low that they turn to cheap solid fuels, which directly contributes to indoor and general air pollution.

Overall, EU countries protect vulnerable customers through a combination of energy-specific protection measures and social security benefits[10]. Most Member States limit disconnection due to non-payment to protect vulnerable consumers. Nine Member States maintain special energy prices or social tariffs for such groups. Other measures, such as (non-)earmarked social benefits to cover energy costs, or exemptions from parts of the energy costs (especially funding contributions to renewable energy or energy efficiency), are less widespread. Only five Member States provide (partial) grants for replacing old appliances with new, more energy-efficient ones.

Renovation and retrofitting policies are praised by energy poverty experts as a way to contain the phenomenon in a sustainable way. Preventive policies are long-term solutions that not only protect households from price fluctuations, but also allow them to understand their consumption better and reduce their environmental footprint. France, England and Ireland are among the few countries implementing significant protective policies, acknowledging that building improvements are essential to mitigation tools. In terms of energy efficiency, given the obsolescence of the building stock, the potential gains are significant, and energy renovation is quickly profitable. For instance, in France, the approach focuses on energy efficiency improvements for "modest homeowners" and redistributive policies via the "Chèque énergie".

In Ireland, the Warmth and Wellbeing Pilot Scheme is offering deep retrofits (valued at up to €20,000) to bring old dwellings closer to current standards through attic and wall insulation, new boilers, and draft

[10] Market Monitoring Report, ACER/CEER, 2017. https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/MMR%202017%20-%20CONSUMER%20PROTECTION.pdf.

proofing. Physicians with patients who are chronically ill from being persistently cold can prescribe the retrofit. A similar project exists in the United Kingdom [Bennis, Mettetal, 2019]. As the energy poor are not necessarily aware of their situation and do not necessarily have contact with the usual identification authorities, general practitioners constitute an original and compelling entry point. The first program of this type was conducted in the north of England in 2014. Six patients suffering from cold-related illnesses were prescribed a certificate entitling them to £9,000 in assistance from the local health center office to renovate their dwellings. Measures such as interior or exterior insulation, double glazing and the installation of a more efficient boiler have increased the average temperature of homes by 3°C and reduced their energy consumption by 36%. In addition, the medical consultations of these patients have decreased by one third, proving the positive impact of these measures on health. Such mechanisms have multiplied in the country, but have not been generalized at the national level, despite the government's promises.

In practice, however, vulnerable households and the energy poor can rarely benefit from energy efficiency programs, due to the costs of the public administration, the lack of resources for the families, and the high administrative burden. This is why pilot projects, such as the ones financed by the European Commission under the Horizon 2020 investment programs, or the Schneider Electric Foundation on innovations to address energy poverty, play such a decisive role in this respect.

7. Member States Are Reluctant to Put the Social Impacts of the Energy Transition at the Top of Their Agenda

While housing policies are the prerogative of national governments rather than a specific competence of the EU, many Member States face similar challenges in this field. A Eurofound study[11] has identified that the annual total cost to the economies of the EU of leaving people living in inadequate housing is nearly €194 billion (e.g. substantial healthcare costs, which have not been assessed for the EU as a whole, and are not integrated into the planning of Member States' housing policies either). Improving the European housing stock would cost about €295 billion at 2011 prices. If all necessary improvements were completed at once, the cost to EU economies and societies would be repaid within 18 months through projected savings such as lower healthcare costs and better social outcomes. In other words, for every €3 invested, €2 would pay back within one year.

In the long term, many of the policy objectives on climate change and energy poverty are fully compatible and mutually reinforcing. How-

[11] Inadequate Housing in Europe.

ever, the considerable potential for the development of energy poverty policy through the EU energy efficiency framework has been limited by national policymakers. They have tended to prioritize climate change, commercial, and environmental objectives over energy poverty goals. Despite the strong wording used in the Energy Efficiency Directive, many countries do not implement or target programs to combat inefficiency and poor housing quality among households affected by energy poverty. Analysis of the draft National Energy and Climate Plans[12] shows that the majority of the European Member States are reluctant to put the fight against energy poverty at the top of their political agendas. Few countries assess the measures providing immediate relief (such as financial compensations, social tariffs or heating allowances) or targeted energy efficiency programs.

The most socially vulnerable and energy-poor families are the ones who could reap the benefits of such measures most quickly. Performant renovations would have a substantial impact on their resilience to climate change. As Poland's draft NECP underlines, energy efficiency renovation strategies for energy poverty are even playing a pivotal role in reducing CO_2 emissions and improving air quality.

8. In the World, the Efforts to "Leave No One Behind" in the Global Energy and Climate Transition Overlook Energy Intensity Improvements

Energy efficiency and investments in cleaner energy sources are more than a fight against climate change: they are a matter of social justice. Between 1990 and 2008, close to 2 billion people worldwide gained access to electricity. Today, about 1 billion people still live without electricity, while hundreds of millions more live with insufficient or unreliable access to it[13]. These circumstances significantly impact issues such as personal safety, household time budgets, labor productivity, and income [Victor, Elias, 2005]. Bad air quality coming from fumes and smoke from open cooking fires is estimated to contribute to the deaths of 1.3 million people per year, predominantly women and children [González-Eguino, 2015]. Energy poverty is a highly gendered problem, with women bearing the brunt of the consequences of inadequate energy access, while suffering from systemic discrimination as well as decreased access to resources and decision-making. Consuming less fuel saves time and money, leaving people with more disposable income and allowing them to invest more in their future. Access to modern forms of energy is essential to overcome poverty, promote

[12] European Commission National Energy and Climate Plans (NECPs), 2019 https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/governance-energy-union/national-energy-climate-plans.

[13] World Bank, 2018. https://www.worldbank.org/en/topic/energy/overview.

economic growth and employment opportunities, support the provision of social services, and, in general, promote sustainable human development [Karekezi et al., 2012].

Access to energy and the decarbonization of energy generation are crucial to ending global poverty and preventing catastrophic climate change. Burning fossil fuels should not be the fate of developing economies, but it is likely that developing countries will contribute more to the problem of climate change over the next 20 years than developed countries. Universal access to affordable, reliable and sustainable energy by 2030—the UN Sustainable Development Goal 7 (SDG)—is essential to reach the other SDGs and is at the center of efforts[14].

In 2011, former UN Secretary-General Ban Ki-moon launched the SEforALL initiative to create the partnerships, to build the evidence base, and to address the critical issues around delivering sustainable energy for all. SEforALL was instrumental in ensuring energy was at the heart of the 17 Sustainable Development Goals adopted in 2015. The objectives of SEforALL were also at the center of the 2015 Paris Climate Conference (COP21). One hundred and ninety-five nations agreed that not only does the increase in the global average temperature need to be held at "well below 2°C above pre-industrial levels", but it is also necessary to pursue efforts to limit the rise to 1.5°C and "leave no one behind" in the global energy transition.

However, a 2019 SEforALL report[15] shows that worldwide, progress on energy efficiency is slowing. The largest energy-intensive economies are seeing improvements in energy intensity decelerate or even come to a standstill, and more concerning is that some countries are moving backwards. The report shows that energy intensity improvements have been largest in Asia, in particular in China, just below the global average in Oceania, Northern America and Europe. In Latin America and Africa, improvement rates are lagging, and absolute levels of energy intensity are less than the global average. All this reflects differences in economic structure, energy supply, and access. Even with sustained improvements in primary energy intensity since 2010, the average rate of growth is still lagging behind the SDG target.

In parallel, several IEA member countries, including Australia, Ireland, New Zealand and the United States, have targeted energy efficiency policies to address fuel poverty with positive results. A study conducted in New Zealand indicated significantly higher monetized benefits among families on low to modest incomes of US$ 519 per year after the retrofitting, compared with US$183 for higher-income families [Telfar-Barnard et al., 2011]. In an analysis of a clustered, randomized community trial on the effects of building insulation in New Zealand, it was

[14] Sustainable Development Goals Knowledge Platform. https://sustainabledevelopment.un.org/sdg7.

[15] SEforALL, 2019. https://www.seforall.org/news/5-key-takeaways-from-the-new-tracking-sdg7-the-energy-progress-report.

found that insulating existing houses led to a significantly warmer, drier indoor environment and resulted in improved self-rated health. Insulation was associated with a small increase in bedroom temperatures during the winter (0.5°C) and decreased relative humidity (–2.3%), despite energy consumption in insulated houses being 81% of that in uninsulated homes (i.e. a 19% reduction) [Politt et al., 2017].

In the United States, low-income households spend about twice as much on energy, as a percentage of income, as the average household[16]. In 2014, close to 40 million households spent 30% or more of their income on housing—the threshold used by the U.S. Department of Housing and Urban Development to identify affordability. Outdated equipment and poor housing conditions also lead to higher than average energy use and costs. The fourth National Climate Assessment, published in November 2018[17], states that "multiple lines of evidence demonstrate that low-income communities and some communities of color are experiencing higher rates of exposure to adverse environmental conditions and social conditions that can reduce their resilience to the impacts of climate change. Populations with increased health and social vulnerability typically have less access to information, resources, institutions, and other factors to prepare for and avoid the health risks of climate change. Across all climate-related health risks, children, older adults, low-income communities, and some communities of color are disproportionately impacted. … If urban responses do not address social inequities and listen to the voices of vulnerable populations, they can inadvertently harm low-income and minority residents". It confirms that climate change is more problematic for poorer Americans[18]. Still, plans connecting housing to climate emergencies are lagging on political agendas—even the Green New Deal effort promoted by Rep. Alexandria Ocasio-Cortez[19].

9. Sufficiency Should Allow a Better Balance Between the Burden of the Costs and the Limited Resources of Our Planet

In Germany, the debates focus more on the energy transition and the cost of renewable energies than on fuel poverty, which has sometimes been addressed as a consequence of the energy transition. Germany has massively developed renewable energies, the financing of which has been funded by households through their electricity bills. While the

[16] Energy Efficiency in Affordable Housing. U.S. Environmental Protection Agency, 2018. https://www.epa.gov/sites/production/files/2018-07/documents/final_affordablehousingguide_06262018_508.pdf.

[17] NCA, 2018. https://nca2018.globalchange.gov/downloads/NCA4_2018_FullReport.pdf.

[18] Bump P. Ocasio-Cortez's Righteous — and Accurate — Anger About Poverty and the Environment. *The Washington Post*, March 27, 2019. https://www.washingtonpost.com/politics/2019/03/27/ocasio-cortezs-righteous-accurate-anger-about-poverty-environment/?noredirect=on&utm_term=.30a9f4822e71.

[19] Aldana Cohen D. A Green New Deal for Housing. *Jacobin Magazine*, August 2, 2019. https://jacobinmag.com/2019/02/green-new-deal-housing-ocasio-cortez-climate.

household electricity bill has been relatively stable since 2013, a significant proportion of this bill corresponds to contributions and taxes, which are continually increasing.

At the end of 2012, the German Minister for the Environment and representatives of civil society concluded that controlling consumption was the only way for households to protect themselves in the long term from rising energy prices. A paradigm of consumer empowerment and reduced energy consumption linked to the energy transition is emerging: energy-poor people are stigmatized for not being able to reduce their consumption or for not participating in the collective effort. Changing citizens' behavior and rationalizing their consumption look like the only way to compensate for them [Bennis, Mettetal, 2019].

Energy represents, on average, 6% of the annual expenditure of the 200 million households in the EU. The lowest-income families spent almost 9% of their total spending on energy in 2014. It corresponds to a 50% increase over the last 10 years, far more than for average households[20]. It is impossible to separate the energy transition from socioeconomic considerations.

We will see in the next pages that energy efficiency improvements can moderate the costs of the transition, and that alternative energy suppliers and producers, along with governments, have a critical role to play in addressing energy poverty by leading to sufficiency.

10. Energy Efficiency Improvements Can Mitigate the Costs of the Transition

Renewable power is the cheapest source of electricity in many parts of the world already today, a 2019 report from the International Renewable Energy Agency (IRENA) shows[21]. Costs from all commercially available renewable power generation technologies declined in 2018. The global weighted-average cost of electricity declined 26% year-on-year for concentrated solar power, followed by bioenergy (–14%), solar photovoltaic and onshore wind (both –13%), hydropower (–12%), and geothermal and offshore wind (both –1%). New bioenergy, hydropower, onshore wind and solar PV projects now commonly undercut new fossil fuel-fired power generation, without financial assistance. Renewables could create more new jobs than those lost in fossil fuel industries. Policy inputs can further improve the socioeconomic footprint of the transformation.

IRENA adds that energy transformation is a catalyst for the gross domestic product, calculating that it could increase by 2.5%, and to-

[20] Clean Energy for All Europeans. European Commission, 2019. https://publications.europa.eu/en/publication-detail/-/publication/b4e46873-7528-11e9-9f05-01aa75ed71a1/language-en?WT.mc_id=Searchresult&WT.ria_c=null&WT.ria_f=3608&WT.ria_ev=search.

[21] Renewable Power Generation Costs in 2018. IRENA, 2019. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/May/IRENA_Renewable-Power-Generations-Costs-in-2018.pdf.

tal employment by 0.2%, globally in 2050. It would also bring broader social and environmental benefits. Health, subsidy and climate-related savings would be worth as much as $160 trillion cumulatively over 30 years, the report finds. Every dollar spent in transforming the global energy system provides a payoff of at least $3 and potentially more than $7, depending on how externalities are valued. The push for renewable energy will be a crucial driver to combat energy poverty when accompanied by household energy efficiency improvements. Renewable energy has become more common as a household energy source. As renewable energy technology develops and capacity increases, the marginal cost of renewables will continue to fall, making them affordable alternatives to conventional energy sources.

However, in most European states, energy prices have been growing faster than the real incomes of the most deprived. This is quite problematic because, on average, household energy consumption in Europe is weakly sensitive to price changes and even to household income changes. A recent Council of Europe Development Bank study[22] shows that, when correlating long-term price elasticity of demand for electricity with the percentage of the low-income population having difficulty in keeping their homes warm, most countries with high levels of energy poverty tend to see household electricity consumption as relatively price inelastic. When prices fluctuate, households usually do not alter their consumption patterns proportionately. For low-income families, this means that they will be paying more for a nominally similar quantity of electricity, at the cost of reducing their consumption of other goods.

It is critical to assess the fair sharing of the costs—in particular, taxes—around the different layers of the population [Claeys et al., 2018]. The resentment expressed by the Yellow Vests in France, which appeared at the end of 2018, is quite symptomatic, as the participants believed that they were unfairly paying more indirect taxes than wealthier fellow citizens. The Yellow Vests thought that the carbon emissions taxes were putting a higher financial burden on their already limited income [Büchs et al., 2011]. The regressive effect of policies is one of the several major barriers to the adoption of effective mitigation policies, which can have considerable social justice implications requiring significant welfare state responses.

In some cases, energy poverty assistance schemes can exacerbate the very condition that they are meant to target by privileging particular groups over others. Regulatory obstacles, information scarcity and sociocultural factors often prevent socially excluded groups from accessing support [Bouzarovski, 2018]. Improving the energy efficiency of the housing stock can directly enhance a country's fiscal position by reducing spending on energy-related subsidies/transfers, thereby freeing up funding space for

[22] Energy Poverty in Europe.

other needed public investments[23]. It adds to the well-known benefits that are the reduction of greenhouse gas emissions, lowering stress on energy grid systems (and making them more stable), helping boost GDP and employment from energy efficiency home construction/retrofits (at least in the medium term), and increasing energy security.

Indeed, rebound effects associated with energy cost reductions at the household level can be significant. Any reduction in energy costs, whether as a result of fuel subsidies or improved energy efficiency, enables households to decide whether to reap energy cost savings or to "reinvest" them in higher living comfort through increases in temperature levels [Milne, Boardman, 2000]. Many low-income families that are lifted out of energy poverty by energy efficiency improvements may choose to increase their indoor temperature, preceding any potential reduction in their energy bills. Still, the ability to enhance the indoor temperature to more comfortable levels may have positive impacts on mental health and incidences of cardiorespiratory diseases, and can help reduce health inequalities [Politt et al., 2017].

11. Could Companies' Alternative Business Models Be the Silver Lining?

Energy companies, whether they are unbundled suppliers, distributors or producers, or even fully bundled parts of closed systems, can be seen as both the cause and part of the solutions in the fight against climate change and energy poverty. Unaffordable energy prices, a non-functional grid with high maintenance costs, and the lack of transparency in the governance and decision-making of incumbent suppliers, as well as the design of the invoice, can put consumers at a higher stage of vulnerability. On the other hand, energy companies are more likely to have the economic powers, the capacity to project into a diversification of the energy sources (investments in renewables), divest, coordinate the modernization of the grids, and stimulate alternative business models such as cooperatives. In some countries, energy companies are directly financing programs (UK, France) and supporting innovative ways to engage with the most fragile elements of our societies (e.g. the project Banco dell'energia in Italy).

In France, for example, since 2006, companies have been contributing to a special fund to finance projects for combating energy poverty, called the national energy efficiency certificates (certificats d'économies d'énergie, or EEC). Energy (electricity, fuel oil, gas etc.) and automotive fuel suppliers and energy producers have to promote energy savings, especially among the energy poor. France's energy poverty mitigation policies focusing on energy efficiency improvements for "underprivileged homeowners" are financed in part by the EEC. For the period

[23] Energy Poverty in Europe.

2018–2020, energy companies should invest more than €2 billion. The State is also expected to allocate €1.2 billion to the fight against energy poverty. In the social housing sector, the objective is to renovate "thermal sieves" at the rate of 100,000 per year by multiplying innovative solutions, with a budget of €3 billion.

In the United Kingdom, energy companies have increased obligations to combat energy poverty, so that today, most financing measures have shifted from the public to the private sector [Bennis, Mettetal, 2019]. In practice, competencies are devolved to England, Wales, Scotland and Northern Ireland separately, and each government has a particular strategy and objectives addressing the poor quality of the dwellings, energy efficiency, and financing their retrofitting programs, where Scotland is the most ambitious. The primary tool is the Energy Company Obligation (ECO), a £640 million per annum scheme designed to improve the energy performance of homes in England, Scotland and Wales, and funded by companies. The UK Government announced that, for 2018–2022, the plan would be focused entirely on low-income and vulnerable households.

However, if suppliers finance the national renovation programs, it is legitimate to ask whether the (financial) assumption of responsibility for public service and solidarity by private actors with profitability requirements is the right strategy. The risk is that unequal treatment of the phenomenon could increase and that the most easily identifiable categories of energy poverty would be favored over others that are less visible or detectable. In many EU countries, local authorities have been transferred powers to combat energy poverty, but without additional funding. Without obligations and in a context of budgetary restrictions, they have little incentive to act, and the principle of territorial fairness is jeopardized.

Government policy and regulators need to create an environment that encourages the development of new finance and business models, which are required in order to raise the levels of energy efficiency investments. For instance, digitalization is seen as the cure-all solution for future energy systems; it would allow a better monitoring of energy use data, an enhanced ability to conduct data analysis, and improvements in connectivity, which enhance the interaction between consumers and devices, enabling greater control and flexibility of use. Digitalization may also create new business models for the delivery of energy efficiency. Nevertheless, maybe the solution does not rely upon technology, but rather human interactions.

12. The Rise of Energy Communities

Portugal has recently committed to building a "fair, democratic and cohesive transition", focusing on several angles likely to have an impact on energy-poor consumers. Improving the housing stocks and involv-

ing the population in the setting-up of renewable energy installations are among the priorities of Portuguese policymakers. Meanwhile, Spain has recently decided to pay special attention to the right to access energy and the right to auto-consumption, and to join an energy community as ways to mitigate energy poverty.

Since 2018–2019, the European Union has unlocked the European development of community-led renewable energy projects. In particular, the EU now explicitly recognizes "citizen energy communities", which involve citizens and local actors. Their primary purpose is to provide environmental, economic or social community benefits to members and shareholders or to the local areas where they operate, rather than to generate financial profits. Initially, the Commission proposed calling "citizen" energy communities "local" energy communities. The change to "citizens" sends a strong political signal that policymakers aim to support business models based around entities whose purpose is to provide services to members or other community benefits, where the ownership and control is with citizens, small businesses and local authorities[24]. Community energy becomes a way to "advance energy efficiency at household level and help fight energy poverty through reduced consumption and lower supply tariffs. Community energy also enables certain groups of household customers to participate in the electricity markets, who otherwise might not have been able to do so"[25].

In practice, energy communities or cooperatives would allow a more significant number of households to participate in the production and distribution of renewable energies, while in some cases, it would lower the network costs by making the grid smaller and more fit-for-purpose. The EU guarantees that energy communities will have a right to share energy, while network operators will be required to help facilitate this activity. Even though many technical and practical details vary at the national level, energy sharing provides numerous opportunities for citizens living in the same areas (e.g. apartment or shared buildings, neighborhoods etc.) to innovate with renewables and other flexible, clean energy technologies like storage. In particular, energy sharing could allow communities to create solidarity mechanisms for benefit sharing to make participation easier for vulnerable and low-income households, and those living in social housing. They can also embed strategies of sufficiency and efficiency, since their primary vocation is not to seek profit.

The rise of energy communities could encourage more fairness in the electricity system. Citizens and energy consumers should take ownership of electricity production and related strategic choices, creating a more sustainable and resilient energy market. Energy democracy might

[24] REScoop, 2019. https://www.rescoop.eu/blog/europe-s-new-energy-market-design-what-does-the-final-piece-of-the-clean?categoryId=39507.

[25] The European Commission Directive on Electricity Market Design, 2019. https://ec.europa.eu/energy/topics/markets-and-consumers/market-legislation/electricity-market-design_en?redir=1.

offer new spaces for collaboration between ecology, social, economic and justice movements. Almost half of EU households could produce renewable energy by 2050, 37% of which could come through involvement in a renewable energy cooperative[26]. Still, it is unclear for now whether, in the European context, the impact will be as significant for the most vulnerable groups and those affected by energy poverty.

A reassessment of human interests, priorities, resources, and means could allow more people to engage in renewable energies and join the momentum toward greater efficiency and sufficiency as well as better sharing of resources if more countries start to consider energy communities better.

Conclusion: Sufficiency Could Make Societies More Resilient to Climate and Social Emergencies

The first victims of the fragmented responses to energy poverty and climate emergencies are the most vulnerable elements of our societies. If lucky enough to have been identified as such, in Western countries, they will be sent from one social service to another and from one technical measure to another, without the benefit of a signposted pathway. Social workers, NGOs, construction and healthcare professionals, and all stakeholders in the field can get too overwhelmed by social emergencies to deal with the climate crisis. Vulnerable and energy-poor communities must therefore create their own resilience schemes, in particular by learning to reuse products and materials.

The collaborative or sharing economy can be a good start to combine the social and climate emergency agendas with the resiliency and sufficiency requirements. For instance, leasing appliances and electronics could enhance product repairing and upgrading, and limit the waste of energy and resources. New trends such as "repair cafés" for small electronics are also noticeable. However, it would be useful to study the inclination of the most deprived to engage in these approaches rather than seek a particular status symbol through the ownership of specific devices.

Europe has launched a fundamental review through the Circular Economy Package (2015–2019). Ecodesign standards will gradually be broadened to require greater resource efficiency in the way products such as white goods are designed (as opposed to just energy efficiency at present). However, there is still a lot to be done from a regulatory point of view, not only in Europe but also in the rest of the world. Perhaps the energy poor have a more sustainable attitude in essence, and they would undoubtedly have a lot to teach in creating a more resilient, sufficient and sustainable society.

[26] REScoop.

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