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Europe's Green Deal: Is the Middle Class Left Behind?

Abstract:

Objective: In this paper, we fundamentally question the Fit for 55 starting assumption that reducing household energy consumption is beneficial or even neutral (i.e. not detrimental) for households in all Member States in the short period up to 2030. This article identifies the plight of households unable to improve their well-being without increasing the consumption of fossil fuels. Tackling energy poverty and addressing social inequality issues is a cornerstone. Around 35 million people live in energy poverty in the European Union (European Commission, 2023), and tens of millions more are at high risk of energy poverty. However, ensuring the well-being of EU citizens requires a broader awareness of the implications of reducing fossil fuel use.

Research Design and Methods: The research methodology relies on a range of quantitative methods: Gini coefficient, Hoover index, Decomposition adjusted Hoover index, rank correlation coefficient, path analysis, and decoupling factors are presented. We also analyze from different perspectives highlighting inequalities and the direct and indirect relationship between residential energy use and HDI and decoupling.

Findings: Based on projected policy impacts, consumers will need to pay more for using fossil fuels. Higher energy taxes will likely impact middle-class families who are not the EU's Climate Fund targets. Based on our previous projections, at least the bottom two-thirds of the middle class (which roughly represents the 2nd, 3rd, and 4th quintiles) also need support. There is a risk that in countries where HDI and per capita household energy use are still tightly connected, the growth in household energy use (driven mainly by higher incomes and increasing human welfare) will be strongly constrained by higher energy costs. In the EU energy convergence will slow down, or even stop, so that the current spatial disparities in HDI and in residential energy use will persist.

Implications: Decreasing the differences in HDI and residential energy use is necessary to achieve social and economic convergence and reduce the inequalities in living standards across the EU Member States. Changes in household energy use in the EU have both direct and indirect impacts on HDI; any increase or decrease in energy use will be immediately reflected in human well-being.

Contribution/Value Added: This article highlighted those countries most exposed to a reduction in well-being. Member States below the saturation point are at a much higher risk of negative impacts of residential energy use on human development. Tackling energy poverty is a very important issue, but in this case, at least the bottom two-thirds of the middle class (which roughly represents the 2nd, 3rd, 4th quintiles) also need support. This could include preferential loans, grants, and technical assistance to enable them to make the necessary energy efficiency improvements and deep renovations that will bring real energy savings.

Article classification: theoretical/review paper

Keywords: residential energy consumption, human development, Fit for 55, energy poverty

JEL classification: *Q43, Q48*

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Introduction

In December 2019, the European Commission presented the European Green Deal, the long-term strategic agenda for integration. It builds on more than ten policy initiatives, such as the 'Fit for 55', 'Circular economy action plan,' and the 'Farm to fork' strategies. One of the three priorities is to 'leave no one behind' in the energy transition. Tackling energy poverty and addressing social inequality issues is a cornerstone. However, ensuring the well-being of EU citizens requires a broader awareness of the implications of reducing fossil fuel use. This article identifies the plight of households unable to improve their well-being without increasing the consumption of fossil fuels. Decoupling household well-being from energy consumption requires refining current EU policies in the Fit for 55 policy package.

The policy goals for Fit for 55 are: 1) Reduce greenhouse gas emissions to net zero by 2050; 2) Decouple economic growth from resource use; 3) Leave no one behind (European Commission, 2021a). The European Green Deal is about ensuring a green, sustainable, fair, transparent, affordable, fast, and comprehensive energy transition that benefits all EU citizens and businesses. The Fit for 55 package aims to achieve a net 55% reduction in greenhouse gas emissions by 2030 through energy efficiency improvements, an increasing share of renewable energy, and energy conservation. In response to Russia's invasion of Ukraine, the European Commission in May 2022 created the REPowerEU plan to accelerate Fit for 55 outcomes to reduce natural gas (Arthur Cox LLP, 2022).

One of its main pillars is the Emissions Trading System (ETS) and the Energy Taxation Directive (ETD) extension feeding the EU's Social Climate Fund. The extension of the ETS to road transport and buildings and the amendment of the Energy Taxation Directive (introducing new ETD minimum taxes) will likely increase household energy expenditure in the long term (European Climate Foundation & Cambridge Econometrics, 2021). This will affect all EU households to varying degrees.

Based on projected policy impacts, consumers will need to pay more for using fossil fuels. The EU's Social Climate Fund contains €87 billion from a carbon tax on petrol, diesel, and heating. Money raised will be directed at vulnerable households. However, as this article shows, human well-being in some EU Member States may decrease in social groups not deemed vulnerable. The 2022 rapid rise in electricity and gas prices prompted governments to deliver aid to households. Higher energy taxes will likely impact middle-class families who are not the EU's Climate Fund targets. Based on our previous projections (Szép et al., 2023; Weiner & Szép, 2022), at least the bottom two-thirds of the middle class (which roughly represents the 2nd, 3rd, and 4th quintiles) also need support not only in Hungary but probably in many other Member States too. It is also confirmed by Steckel et al. (2022), who focus on the regressive impact of soaring energy prices. They conclude that "energy prices increases affect low- and middle-income households more than high-income households relative to their total expenditures" (Steckel et al., 2022, p. 2).

In practice, a minimum tax will double France's gas heating cost by 2030. In Poland, it will increase by 70% (compared to the level before the adoption of Fit for 55), with 17% of the population in the latter country currently living in energy poverty (European Climate Foundation & Cambridge Econometrics, 2021). Even if Polish households choose a heating fuel not covered by the ETS, minimum taxes would still increase their energy expenditure on heating by 25%, significantly reducing disposable income (European Climate Foundation & Cambridge Econometrics, 2021).

There is a dramatic need to deliver effective policy responses. It is envisaged that the most vulnerable households, those living in energy and mobility poverty, will benefit from support based on the ‘Social Climate Fund’ (European Commission, 2021b). The current energy crisis (2021–2022) illustrates that even developed Western European countries (e.g. the Netherlands, Germany, or the former EU member UK) need to make considerable efforts to support households, improve energy efficiency, and reduce energy use. The burden is proportionally even greater in post-communist countries due to lower incomes.

In this paper, we fundamentally question the Fit for 55 starting assumption that reducing household energy consumption is beneficial or even neutral (i.e. not detrimental) to households in all Member States in the short period up to 2030. The aim is to show that higher energy use in the household sector is closely linked to higher human development in the European Union (in this case HDI), which, as defined by the UN, is about expanding people’s freedom and opportunities as well as improving their well-being, and about the real freedom that people may choose who they want to be, what they want to do, and how they want to live (United Nations, 2015). There is a risk that in countries where HDI and per capita household energy use are still tightly connected, the growth in household energy use (driven mainly by higher incomes and increasing human welfare) will be strongly constrained by higher energy costs associated with expanded ETS and ETD schemes. Thus, compared to those countries where decoupling has already taken place, residential energy use will stabilise at a lower level. In the EU energy convergence will slow down, or even stop, so that the current spatial disparities in HDI and in residential energy use will persist.

The rest of this paper is organised as follows. The literature review section summarises the main research findings. The research methodology section introduces the applied data and methodology: Gini coefficient, Hoover index, Decomposition adjusted Hoover index, rank correlation coefficient, path analysis, and decoupling factor are presented. The following section shows the results, including our main finding on inequalities, direct and indirect relationship between residential energy use and HDI, and decoupling. Broad policy options are provided in the conclusion section to address those countries most disproportionally affected by Fit for 55. The hypotheses tested in this study are:

- H1: There are major inequalities in residential energy use between Member States.
- H2: There is still a strong link between residential energy use and human development in the European Union. However, the east-west divide between Member States is also evident here, with the old Member States showing a much weaker relationship between energy use and human development than the post-communist countries.
- H3: Fit for 55 neglects the impact of residential energy use on human development and jeopardises the social and economic convergence of the European Union.

Literature review

There is a void in the current energy policy, which recognises regional differences in energy use in the European Union. Convergence of residential energy use is not included in the Fit for 55 objectives, and the impact of measures on human development is not examined. These factors are not taken into account in the 2050 Carbon Neutrality Plan. Yet, social and economic convergence has always been a significant vision of the European Communities and later of the European Union. In what follows, we will put energy inequalities in a broader context, show the relationship between residential energy use and human development, and identify those Member States where these two factors are still closely linked.

As the World Bank points out, after the impact of the 2008 financial crisis, the 'convergence machine' in the post-socialist region has accelerated (Ridao-Cano & Bodewig, 2018, p. 18). If one of the main benefits of EU membership is convergence to higher living standards (and human development), which obviously translates into higher GDP and disposable income, higher quality of education, health, housing and living conditions, then it is to be expected that inequalities in other areas will also be reduced. For example, research in Poland demonstrates the benefits of energy efficiency renovations for employment, the economy, and the wellbeing of society (Urge-Vorsatz, Wójcik-Gront, and Tirado Herrero 2012). More broadly an awareness of the co-benefits of energy consumption and energy efficiency on living conditions can also deliver rapid benefits to society (Pachauri, Urge Vorsatz, and LaBelle 2012). In other words, there may be a need to minimise differences in household energy consumption (adjusted for climate) with an awareness of the benefits of policy implementation. Overall, the distributional effects of climate and energy policies are regressive, so they increase the existing inequalities (Vona, 2023).

Practical experience shows that human well-being is closely linked to final energy consumption. However, in parallel with economic development, this strong positive correlation weakens over time, and the importance of energy use declines, removing the 'push' or incentive effect (Wu et al., 2012). Energy use and human well-being decoupling is called the saturation point (Arto et al., 2016; Martínez & Ebenhack, 2008) or a plateau point (e.g. (Mazur, 2011; Nadimi & Tokimatsu, 2018; Pasternak, 2000). Beyond this point, the correlation becomes weak. Increasing energy use does not contributes to human development beyond this saturation point. Therefore, higher human well-being is sustainable even with decreasing energy use (Martínez & Ebenhack, 2008; Mazur, 2011; Steinberger & Roberts, 2010, p. 425; Tran et al., 2019).

The theory of the relationship between energy use and human development is well established, with six main approaches:

1. decoupling analysis aiming to determine the saturation points (e.g. Akizu-Gardoki et al., 2018; Arto et al., 2016; Brecha, 2019; Dias et al., 2006; Krugmann & Goldemberg, 1983; Martínez & Ebenhack, 2008; Pasternak, 2000; Steinberger & Roberts, 2009, 2010; Tran et al., 2019);
2. social inequality studies (e.g. Gaye, 2007; Jacmart et al., 1979; Jacobson et al., 2005; Pachauri & Spreng, 2004; Wu et al., 2012);
3. energy convergence and other spatial inequality studies (e.g. Gaye, 2007; Jacmart et al., 1979; Jacobson et al., 2005; Pachauri & Spreng, 2004; Wu et al., 2012);
4. causality analysis (e.g. Assadzadeh & Nategh, 2015; Jorgenson et al., 2014; Kanagawa & Nakata, 2008; Mazur, 2011; Nadimi & Tokimatsu, 2018; Ouedraogo, 2013; Pasten & Santamarina, 2012; Ray et al., 2016; Sušnik & Zaag, 2017; Sweidan & Alwaked, 2016);
5. studies estimating the minimum level of energy use (thresholds level) required to achieve a certain level of human well-being (e.g. Brecha, 2019; Dutta et al., 2018; Krugmann & Goldemberg, 1983; Leung & Meisen, 2005; Martínez & Ebenhack, 2008; Pasternak, 2000; Steinberger & Roberts, 2009, 2010);
6. empirical research estimating the distributional effect and establishing offsetting policies (Steckel et al., 2022; Vona, 2023).

Research methodology

The analysis of the relationship can be carried out at the level of the national economy, but also for individual sectors or consumers (households, companies). This study focuses on households that play a key role in meeting environmental, energy, and climate targets (both 2030 and 2050). Households accounted for 28.03% of final energy consumption in 2020, making them the second largest energy user in the European Union after the transport sector (Eurostat, 2022). The study of households, focusing on inequalities and disconnection in household energy use, is an underrepresented research area in energy economics (Wu et al., 2012). The main objective of this study is to fill at least a part of this gap due to investigate the distribution of household energy use and identify saturation points in the European Union, 2000–2020. To make the analysis more structured and in-depth, the 27 EU Member States are divided into two main broad groups and 7 sub-groups based on energy cultures (LaBelle, 2020):

1. 14 old member states plus Cyprus and Malta (OMS):
   - Scandinavia (Denmark, Finland, Sweden),
   - West (Austria, Belgium, France, Germany, Ireland, Luxembourg, the Netherlands),
   - Mediterranean (Cyprus, Greece, Italy, Cyprus, Malta, Portugal, Spain, Portugal);
2. 11 post-communist member states (PCMS):
   - Baltic States (Estonia, Latvia, Lithuania),
   - Visegrád Four (the Czech Republic, Hungary, Poland, Slovakia),
   - Former Yugoslavia (Croatia, Slovenia),
   - Later joiners (Bulgaria, Romania).

Several factors, including different development paths and economic characteristics, justify the separate analysis of each group of countries. In the post-communist Member States (as a result of major political and economic changes), a transition from planned to market economies has taken place and is still ongoing. Most of these countries have inherited an energy-intensive industrial sector, long dominated by heavy industry, and which still struggle with a high dependence on primary energy sources and other raw materials. The economic structure has changed significantly over the last three decades, and energy intensity has improved due to de-industrialisation processes coupled with technological progress. However, PCMS countries have lower energy efficiency in end-use sectors compared to the OMS group. This is especially true for the household sector, where energy poverty is still an existing problem, which can be explained by poor (technically-obsolete) buildings, relatively high energy prices and low disposable income (LaBelle & Georgiev, 2016; Weiner & Szép, 2022).

The quantitative analysis can be divided into three main parts. First, the territorial differences and inequalities are examined regarding the residential energy use per capita in the EU member states. In order to do that, we apply the Gini coefficient, the Hoover index, the Decomposition adjusted Hoover index, and the rank correlation coefficient. Secondly, a path analysis is conducted to reveal the relationship between the residential energy use per capita and the HDI. Thirdly, the decoupling factor is calculated with a double purpose: a) identifying the EU member states that have already reached the saturation points (delinking of residential energy use per capita from HDI can be observed); and b) describing these saturation points.

Table 2 shows the applied tools for measuring inequalities. A Gini coefficient of zero expresses perfect equality, while a Gini coefficient of 1 refers to maximal inequality among values (Nemes Nagy, 2005). The Hoover index ranges from 0 to 100%. It shows what percent of the examined attribution should be redeployed among the examined territorial units to make its spatial distribution exactly the same as that of the other attribution examined Nemes Nagy, 2005). Furthermore, the Hoover index can be decomposed into components based on different country groups (so-called decomposition adjusted Hoover index). The rank correlation coefficient measures the degree of similarity between two rankings, and it may highlight the changes of rank over time. The coefficient is high (but the maximum value is 1) when observations have a similar rank (Kincses, 2015; Nemes Nagy, 2005).

Table 1 presents the applied data and its sources. The sample period is from 2000–2020. For the cross-sectional analysis, three years are highlighted: 2000, 2010, and 2020.

Table 1. Applied data and their abbreviations

Abbreviation	Indicator	Source
HDI	Human development index	(UNDP, 2020)
POP	Population on 1 January – total [persons]	(Eurostat, 2022)
RES	Final energy consumption in households per capita (Final consumption – other sectors – households – energy use/ Population on 1 January – total) [toe]	own calculation based on (Eurostat, 2021)
SHE	Share of households in final energy consumption (Final energy consumption in households/Final consumption for energy use) [%]	own calculation based on (Eurostat, 2021)
DIST	Inequality of income distribution [%]	(Eurostat, 2022)
HEX	Final consumption expenditure of households per capita (current prices, EUR per capita)	(Eurostat, 2022)
URB	Urbanisation [urban population, % of total population]	(World Bank, 2022)
MAN	Manufacturing, value added [% of GDP]	(World Bank, 2022)
GDP	GDP growth [Gross domestic product at market prices, 2010=100%]	(Eurostat, 2022)
GDPCAP	GDP per capita (current prices, million EUR)	(Eurostat, 2022)
FDI	Foreign direct investment, net inflows [% of GDP]	(World Bank, 2022)
CO_2	Carbon dioxide emission per capita [tonne]	(Eurostat, 2022)
MET	Methane emission per capita [tonne]	(Eurostat, 2022)
NIT	Nitrous oxide emission per capita [tonne]	(Eurostat, 2022)
REN	Share of renewable energy in gross final energy consumption [%]	(Eurostat, 2022)
HDD	Heating degree days [number]	(Eurostat, 2022)
CDD	Cooling degree days [number]	(Eurostat, 2022)

Source: developed by the authors.

In the path models, the zero-order linear correlation between the independent and dependent variables is divided into two parts. One part is the effect that our independent variables (primary and secondary explanatory factors) have directly on the dependent variable (HDI), and the other part is the effect that the independent variables exert through other intermediate variables (indirect effect). The primary explanatory factor is the residential energy use per capita, and the secondary explanatory factors are selected variables listed in Table 1. The main purpose is to determine the direct and indirect effect of the primary explanatory factor on the dependent variable. It means that the relationship between residential energy use and the HDI is broken down into indirect and direct parts in an additive way. In this paper, we will refrain from presenting the methodology in detail, as our main aim here is to put the analyses carried out earlier (LaBelle et al., 2022) in a broader context.

Table 2. Applied indicators to measure the territorial differences and inequalities

Indicator	Formula
Gini	$$G = \frac{1}{2 * x * n^2} \sum_i \sum_j \left| x_i - x_j \right| \quad (1)$$ where n is the number of observations (it is the sample of size), is the average of x_i, x_i is a distribution rate of a territorially related characteristic in *i*th country, and x_j is the distribution rate of a territorially related characteristic in *j*th country.
Hoover index	$$H = \frac{1}{2} * \sum_{i=1}^{n} \left| x_i - f_i \right| \quad (2)$$ $$\sum x_i = 100 \quad (3)$$ $$\sum f_i = 100 \quad (4)$$ where x_i and f_i are distribution rates.
Decomposition adjusted Hoover index	$$H = \frac{1}{2} * \sum_{i=1}^{n} \left| x_i - f_i \right| = \frac{1}{2} \left(\sum_{j=Scandinavian} \left| x_j - f_j \right| + \sum_{k=Western} \left| x_i - f_i \right| + \sum_{l=Baltics} \left| x_l - f_l \right| + \sum_{m=Mediterranean} \left| x_m - f_m \right| + \sum_{n=V4} \left| x_n - f_n \right| + \sum_{o=formerYugoslavia} \left| x_o - f_o \right| + \sum_{p=laterjoiners} \left| x_p - f_p \right| \right) \quad (5)$$
Rank correlation coefficient	$$r_s = 1 - \frac{6 * \sum_{i=1}^{n} d_i^2}{n * \left(n^2 - 1 \right)} \quad (6)$$ where n is the number of observations (it is the sample of size), d_i is the difference between the two ranks of each observation.

Source: Nemes Nagy (2005).

To measure the decoupling, two indicators are introduced, the decoupling ratio and decoupling factor (*D*). Following the pioneering work of the OECD (2002), here the decoupling factor is determined as follows (OECD, 2002, p. 19):

$$D = 1 - decouplingratio = 1 - \frac{RES_t}{HDI_t} \bigg/ \frac{RES_{t-1}}{HDI_{t-1}} \quad (7)$$

where *RES* is the residential energy use per capita, *HDI* is the Human Development Index, *t* is the current year.

If $D > 0$, the trends of the examined indicators are separated (the intensity decreases, which means that the growth rate of the residential energy use per capita is lower than the growth rate of HDI) so the decoupling is fulfilled. The maximum value of *D* is 1. If $D \leq 0$, the decoupling does not occur (the growth rate of residential energy use per capita exceeds the growth rate of HDI), and this is a case of non-decoupling (Szép et al., 2022). We assume that the year in which the decoupling occurs (and becomes permanent) also marks the saturation point.

Results

For starting, bivariate linear regression models are calculated (Figure 1). The residential energy use per capita is plotted against HDI for European Union member states (the conventional way is followed, with the explanatory variable being plotted on the *x* or horizontal axis and the dependent variable plotted on the *y* or vertical axis). The R^2 value decreases from 2000 to 2020 (it was 0.49 in 2000 and 0.28 in 2020), which refers to a weakening (but still positive) relationship and to the decoupling process. R^2 indicates the percentage of the variance in the dependent variable (residential energy use per capita) that the HDI (as an independent variable) explains collectively.

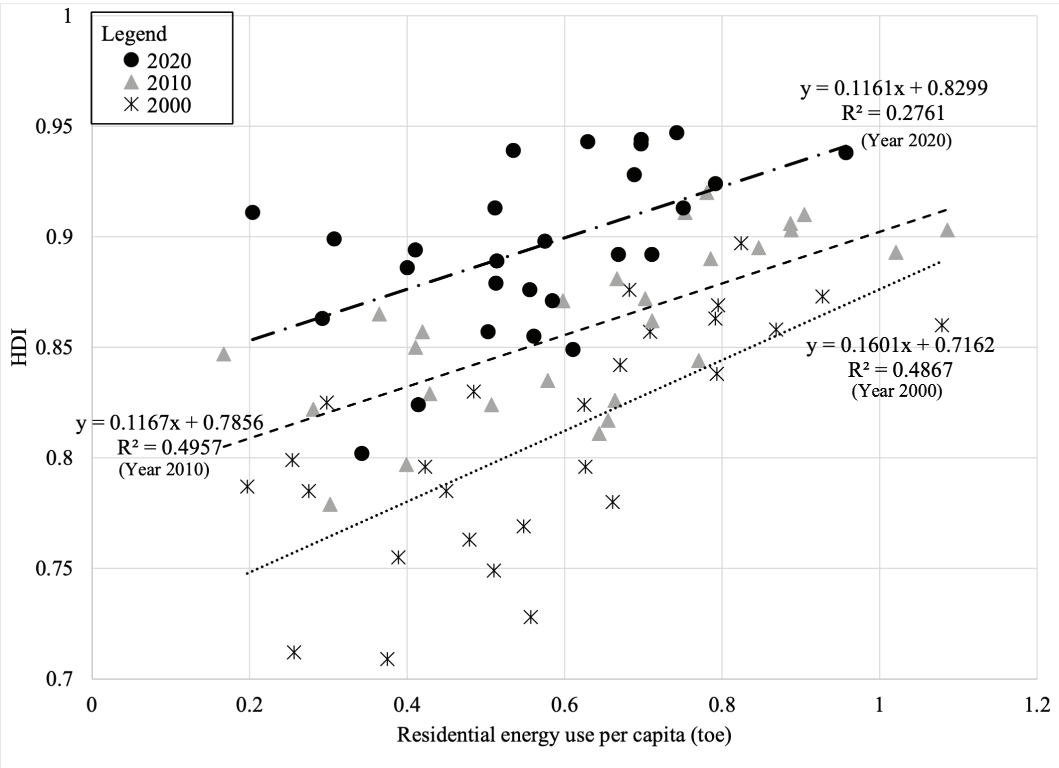

Figure 1. Data and regressions of HDI vs. residential energy use per capita (toe) in the EU member states, 2000, 2010, 2020

Source: developed by the authors

Our results (Table 3) show significant regional differences in household energy use among the nations in the European Union, and this is true for different country groups and within these groups. However, the Gini coefficients on residential energy use per capita basis for GDP per capita and the residential final consumption expenditure per capita are similar and show lower concentration levels. Thus, the territorial distribution and spatial inequalities of residential energy consumption per capita represent the differences in economic development (GDP per capita and residential final consumption expenditure per capita), and a strong relationship is identified between them. This also shows that per capita household energy use remains primarily a function of development (and income). For a detailed discussion, see LaBelle et al. (2022); Szép et al. (2022).

Table 3. Gini coefficients and Hoover index results in the EU Member States (2000, 2010, 2020)

	2000		2010		2020	
Index compared to the residential energy use per capita	**Gini**	**Hoover (%)**	**Gini**	**Hoover (%)**	**Gini**	**Hoover (%)**
POP	0.621	51.329	0.627	51.429	0.626	50.903
GDPCAP	0.332	23.468	0.275	20.041	0.287	20.585
HEX	0.291	22.977	0.256	18.122	0.212	15.870

Source: developed by the authors.

The Hoover index (Table 3) shows that in 2000, 51.33% of the residential energy use per capita would have to have been redeployed among the European Union member states in order to be equal to the characteristics of the population and thus to create territorial equality. This relatively high number on the Hoover index highlights significant territorial inequality.

Examining the territorial distribution of the residential energy use per capita compared to the GDP per capita and to the final consumption expenditure of households per capita, the Hoover index is no higher than 24%; moreover, it shows a decreasing tendency from 2000 to 2010. This means that the energy use of the households mainly depends on their final consumption expenditure (and eventually on their income situation), although the territorial distribution of the two indices (i.e. residential energy use per capita and the final consumption expenditure of households per capita) is slightly different. Results confirm that the energy use of the households is in line with their economic development.

In the following, the inequalities related to residential energy use are analysed in detail, highlighting which country groups have distorted most of the territorial distribution of indicators related to the household sector (Table 4). In the case of the residential energy use per capita compared to population, the difference in the distribution was two times higher in OMS than in PCMS. In the other two cases (GDP per capita and final consumption expenditure of households per capita), the explanatory power of the two main country groups is nearly similar. The Hoover index in all cases show the dominance of the Western countries and the V4 in inequality, followed by the Mediterranean and the Baltic States.

The rank correlation coefficients (Table 5) in all years and in all cases are close to 1, which refers to small changes in the rank (the observations have a similar rank). Only minor changes in the rank of the European Union member states can be identified. Considering the Hoover index and the rank correlation results, it can be stated that most of the redistribution (declining inequalities) has occurred among predefined country groups, not within groups.

Household energy use per capita shows a significant, moderately strong relationship with human development between 2000 and 2020, but the strength of the relationship decreases over time. It can be demonstrated that household energy use plays an essential role in the evolution of human well-being (i.e. the spatial distribution of the dependent variable), directly affecting the HDI significantly in all three years (2000, 2010, 2020). In general, it can be concluded that residential energy use is not only indirectly influenced through indicators describing the socio-economic-environmental situation, but also directly (Table 6). HDI improves in parallel with

Table 4: Decomposition results of Hoover index

Index compared to the residential energy use per capita	**Country groups**	**2000**	**2010**	**2020**
POP	**old member states plus Cyprus and Malta**	37.260	37.367	36.234
	Scandinavian	5.728	6.058	5.478
	Western	20.945	20.148	19.331
	Mediterranean	10.588	11.161	11.425
	post-communist member states	14.069	14.062	14.669
	Baltics	4.316	4.862	5.287
	V4	5.313	4.937	5.387
	former Yugoslavia	2.894	3.084	2.848
	later joiners	1.546	1.179	1.148
	Hoover index (European Union member states)	51.329	51.429	50.903
GDPCAP	**old member states plus Cyprus and Malta**	12.284	10.495	11.271
	Scandinavian	2.362	1.695	1.827
	Western	5.954	5.552	7.467
	Mediterranean	3.968	3.248	1.976
	post-communist member states	11.185	9.546	9.314
	Baltics	3.867	3.445	2.779
	V4	4.444	3.306	3.807
	former Yugoslavia	1.042	1.626	1.447
	later joiners	1.831	1.170	1.281
	Hoover index (European Union member states)	23.468	20.041	20.585
HEX	**old member states plus Cyprus and Malta**	12.366	9.756	8.342
	Scandinavian	1.338	1.020	1.359
	Western	4.414	3.055	3.646
	Mediterranean	6.614	5.680	3.337
	post-communist member states	10.611	8.366	7.528
	Baltics	3.673	3.126	2.236
	V4	4.301	3.103	3.363
	former Yugoslavia	0.868	1.193	1.001
	later joiners	1.769	0.945	0.928
	Hoover index (European Union member states)	22.977	18.122	15.870

Source: developed by the authors.

an increase in per capita energy use and vice versa, with a decrease in per capita energy use associated with a deterioration in HDI. Therefore, if there were an increase in residential energy use in the European Union, the impact on countries' HDI would be realised in a relatively short period, as it is not only indirectly through other factors but also directly.

Table 5. Rank correlation coefficients

	2000-2010	2010-2020	2000-2020
RES	0.976	0.910	0.908
POP	0.996	0.985	0.990
GDPCAP	0.986	0.937	0.917
HEX	0.965	0.949	0.962
HDI	0.969	0.897	0.916

Source: developed by the authors.

Table 6. The role of direct and indirect paths in explaining the HDI (standardised β coefficients)

	HDI, 2000	HDI, 2008	HDI, 2018
Indirect	0.152	0.027	0.255
Direct	0.539	0.687	0.319
Total	0.691	0.715	0.574

Source: LaBelle et al. (2022, p. 12).

However, rising energy prices and overheads due to the Russian-Ukrainian war and, in the long term, the Fit for 55 (based on the ETS expansion and the ETD plan) will strongly restrain residential energy use, which, due to the mechanism described above, could put at risk the human welfare achieved and lead to its decline. Inappropriate distribution of energy use (existing inequalities of the residential energy use), the violation of the well-known dimensions of energy security (such as availability, affordability, accessibility, and acceptability – the so-called 4A concept) can cause severe social, environmental, and economic inequalities between different social groups and territorial units (Jacobson et al., 2005; Wu et al., 2012), further jeopardising social and economic convergence.

Of course, these risks are manifested differently at the level of each Member State due to inequalities in household energy use. It is expected to be much lower in countries where the household sector has already reached saturation point. However, for Member States consuming below the saturation point, a reduction in household energy use could have a serious impact on human welfare, reducing it. The next important step is to identify which countries have already decoupled their household energy use from their HDI, i.e. where the risk of a decline in human well-being is lower.

An examination of decoupling should give cause for optimism, as most Member States had achieved absolute or relative decoupling by the end of the period under review. Once separation has occurred, this positive trend has not been reversed, i.e. in most cases, separation has become permanent. In the European Union, 20 countries have reached the saturation point with an average HDI of 0.85. No separation occurred below an HDI of 0.794, but at the latest an HDI of 0.922

(Table 7). The following countries, however, have not yet reached the saturation point: Bulgaria, Cyprus, Finland, Hungary, Italy, Lithuania, and Poland (Figure 2).

It can be seen that the link between residential energy use and human well-being is still stronger in the former Eastern Bloc countries. This legacy has a strong impact on their national and sectoral energy use. In the European Union, countries with a lower HDI have the right to be on a par with countries with a high HDI. In this context, there are only two options to reach the same higher human development levels as Western Europe: 1) further increase the use of fossil fuels, or 2) launch comprehensive energy efficiency programmes, with the incremental increase being covered by renewable energy sources.

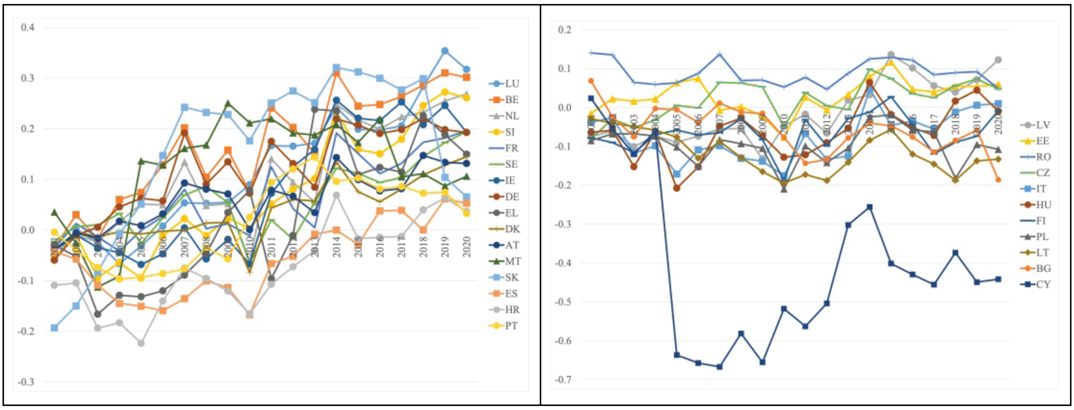

Figure 2. Decoupling factor (D, 2000–2020) for EU member states

Source: developed by the authors

Table 7. Saturation points

	year	HDI	GDPCAP [Current prices, EUR per capita]	HEX [Current prices, EUR per capita]	RES		
					[TOE]	[GJ]	[GJ] Climate corrected
Austria	2004	0.849	29 670	15 440	0.790	33.076	30.560
Belgium	2004	0.885	28 480	13 850	0.884	37.011	41.395
Croatia	2018	0.856	12 880	9 170	0.560	23.446	29.826
the Czech Republic	2007	0.850	13 470	6 430	0.626	26.209	26.820
Denmark	2011	0.922	44 500	20 630	0.809	33.871	34.783
Estonia	2002	0.799	5 660	3 050	0.662	27.717	23.228
France	2006	0.865	29 050	15 230	0.670	28.052	34.010
Germany	2003	0.889	27 120	14 860	0.809	33.871	34.371
Greece	2013	0.858	16 480	11 210	0.347	14.528	19.993
Ireland	2011	0.894	37 310	16 980	0.606	25.372	27.906
Latvia	2013	0.834	11 350	6 890	0.626	26.209	23.152
Luxembourg	2006	0.884	71 490	23 420	1.101	46.097	51.650

Table 7 – continued

	year	HDI	GDPCAP [Current prices, EUR per capita]	HEX [Current prices, EUR per capita]	RES		
					[TOE]	[GJ]	[GJ] Climate corrected
Malta	2005	0.828	12 730	7 810	0.179	7.494	8.734
the Netherlands	2004	0.886	32 510	15 820	0.679	28.428	31.295
Portugal	2010	0.822	16 990	10 890	0.281	11.765	13.815
Romania	2001	0.715	N/A	N/A	0.325	13.607	14.276
Slovakia	2005	0.794	7 310	3 950	0.473	19.804	18.970
Slovenia	2009	0.877	17 760	10 090	0.650	27.214	29.816
Spain	2016	0.888	23 990	14 460	0.309	12.937	15.844
Sweden	2002	0.903	31 600	14 380	0.824	34.499	26.844

Source: developed by the authors.

Conclusions

Our analyses highlight inequalities in residential energy use in the EU; we thus accept hypothesis H1. However, the differences in energy use follow development differentials, showing a lower, decreasing concentration. Beyond the disparities, the strong relationship between per capita energy use and human well-being in the European Union is also confirmed (so does hypothesis H2, too). But the strength of this relationship also weakens over time.

Throughout our research, we assumed that convergence remains a long-term goal of the European Union and that policymakers do not intend the Fit for 55 package to preserve the lower levels of human development in the PCMS countries. Decreasing the differences in HDI and residential energy use is necessary to achieve social and economic convergence as well as reduce the inequalities in living standards across the EU Member States. Changes in household energy use in the EU have both direct and indirect impacts on HDI; any increase or decrease in energy use will be immediately reflected in human well-being. This is very marked in countries below the saturation point (Bulgaria, Cyprus, Finland, Hungary, Italy, Lithuania, and Poland): increasing household energy use is needed to improve human development, which runs counter to the Fit for 55 objectives.

An essential commitment of the strategy is to reduce both primary and final energy use. Two critical instruments for this are the extension of the ETS and the ETD restructuring, which foresee an increase in energy prices. This will curb residential energy use, which can only be achieved at the expense of human development without accelerating the decoupling process. In the long term, without broader consideration and support policies, Fit for 55 may contribute to household inequalities in some countries rather than support a rise in human development.

Policy recommendations

In reducing residential energy use, particular attention must be paid to human development. Until the decoupling of the two indicators occurs, i.e. the strong positive correlation between them is weakened, households will have to increase their energy consumption in order not only to maintain but also to increase the level of human development achieved as well as to achieve social and economic convergence in the European Union.

After the turn of the millennium, most EU Member States have reached a saturation point, which is a cause for optimism. At least 20 countries seem to be moving away from HDI in their per capita energy use. In the long term, this will allow economic and social development by decreasing energy use in the household sector, contributing to a sustainable energy transition. Technological development, climate change mitigation policies, and changing attitudes will help meet the population’s needs in a less energy-intensive way.

This article highlighted those countries which are most exposed to a reduction in well-being. Member States below the saturation point are at a much higher risk of negative impacts of residential energy use on human development. However, given energy and climate objectives, there is certainly no scope for households to increase their energy use intensively in the hope that decoupling can be achieved sooner. Taking a practical approach to the observed correlation (that any increase – or decrease – in energy use is immediately reflected in human welfare), we break this down to highlight the importance of policy intervention to prevent a rise in energy consumption.

Around 35 million people live in energy poverty in the European Union (European Commission, 2023), and tens of millions more are at high risk of energy poverty. In their case, increasing their energy use (e.g. increasing heating temperatures – keeping to the WHO recommended 21°C, heating a higher proportion of the inhabited area) would have obvious short-term benefits and would also lead to an increase in the quality of life (reduction or even elimination of mould and damp, health improvement), with a positive impact on HDI.

For the other deciles (mainly middle class), households have also not yet reached the saturation point, at least in the seven countries indicated. This has many components, and the list may vary from country to country: families do not have as many electronic appliances as those in the other 20 countries, buildings are energy inefficient, the heated living space per capita is smaller, etc. So, there would be scope for further increasing energy use (and thus human development) in the household sector, which contradicts energy and climate goals.

On the one hand, households in these seven Member States should be allowed to engage in more energy-intensive household activities, i.e., to increase energy use. These activities could be heating, cooking, water heating, cooling, lighting, and electrical appliances, according to the purpose of the energy use. But increasing household energy use in absolute terms is not the answer. So, on the other hand, energy intensity of these activities should be improved through appropriate investments in energy efficiency, and if energy use were to increase, it should be provided by renewable energy sources.

Energy poverty is also a challenge to be addressed. A further problem is that the average annual renewal rate of the housing stock in these countries is also low, pointing to a lack of investment in energy efficiency. Reducing residential energy use without comprehensive energy efficiency programmes is not feasible in the lowest income deciles. Assuming, of course, that the property can be renovated. However, some of the properties cannot be saved or only so at a steep price. In the absence of such programmes, and with rising energy prices and an increase in the proportion of people living in energy poverty, the problem is likely to worsen.

European Union policymakers have sensed the social dangers of energy price rises, with some calling the plan itself ‘political suicide’, which will lead to an increase in anti-EU voices. The Social Climate Fund, worth €87 billion (Kurmayer, 2022), is intended to prevent this, in effect recycling part of the carbon tax paid by the public through subsidies. The bulk of this will be used for energy efficiency investments, with two priority target groups: the most vulnerable (i.e. the poorest) households and micro-enterprises. We believe that who the most vulnerable households are, those most exposed to price rises, is grossly underestimated.

Tackling energy poverty is a very important issue, but in this case, at least the bottom two-thirds of the middle class (which roughly represents the 2nd, 3rd, 4th quintiles) also need support. This could include preferential loans, grants, and technical assistance to enable them to make the necessary energy efficiency improvements and deep renovations that will bring real energy savings. Information centres should be established, and one-stop shops should be promoted. This is confirmed by the IEECP (2022), which calculates that even for low-income households, this resource will not be sufficient to make the necessary energy efficiency improvements by 2040. On this basis, we also accept hypothesis H3. The main challenge of Fit for 55 is to reduce residential energy use while increasing human development and achieving the saturation point for all Member States by achieving decoupling and energy convergence.

Failing this, stagnation or an increase in territorial disparities can be expected. From a policy point of view, the implementation of Fit for 55, if it does not include complex energy efficiency programmes and intensive support for renewable energy sources, works against economic and social convergence, which is one of the main objectives and visions of the European Union. This could amplify anti-European voices, increasing the sense of social injustice and exclusion. Taking human welfare into account is essential when making responsible energy decisions.

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