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EU Consumers, Renewable Energy, and Sustainable Development – An Exploratory Market-Oriented Research Approach

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ABSTRACT:
The European Union countries are working to reach the truly ambitious objective of achieving a climate-neutral continent by 2050. Increasing the employment of renewable energy is one of the strategic directions promoted to fulfill this purpose. Although the socioeconomic and political context has accelerated the use of renewable energy sources, shifting to green energy raises significant challenges and generates a substantial impact both at the macroeconomic and microeconomic levels, with particular attention given to the overall behavior of the EU consumers within this transitional process.
The paper presents the results of an exploratory approach aiming to assess, based on the secondary data and from a market-oriented perspective, the relationships between the production, consumption, and share of renewable energy, the attitude of EU consumers toward renewable energy and the extent to which they are willing to consider it as a reliable alternative to the traditional energy, in connection to the economic, social, and environmental dimensions of the sustainable development in the EU Member States.

Keywords: Renewable energy, EU consumers, Marketing, Sustainable development

1. Introduction

European Union's ambitious objective of achieving a climate-neutral continent by 2050 depends a great deal on the energy sector since 75% of EU greenhouse gas emissions come from energy production and consumption (European Commission, 2023). Considering that the world's total energy supply increased by 68.2 % between 1990-2019 (United Nations, 2022), accelerating the transition to clean energy becomes even more urgent and the European Union seems to lead the way (Eyl-Mazzega and Mathieu, 2020). EU's share of the World's total energy supply has been steadily declining over the last 30 years from 14.70 % (1990) to 9.68 % (2019), with similar evolutions being registered by the share of the World's energy production – from 6.79 % to 4.12 %, respectively the share of the World's total final consumption – from 14.66 % to 10.16 % (European Commission, Directorate-General for Energy, 2021). The fossil-based energy sources have dominated the World energy sector with the share of petroleum and related products, solid fuels, and natural gas slightly increasing between 1990 and 2019 from 80.47 % to 80.87 % (European Commission, Directorate-General for Energy, 2021).

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Although the European Commission outlined a policy and offered some specific measures to create a common market in 1968, the energy and energy policy started to become a significant topic at the European level only in the middle of the 1990s, when the energy market and its specific regulation were transforming in a context marked by crisis periods, due to the technological progress, renewable energy deployment, and changes in the energy consumers' behavior (Ferreira et al., 2022). A strategic direction emerged and consolidated in the last decades aiming to position renewable energy sources as the main alternative to fossil fuels (Stec and Grzebyk, 2022; Chudy-Laskowska and Pisula, 2022), playing a key role in decarbonizing the economy (Bórawski et al., 2022).

The transition to renewable energy has been fostered by European policies during the last decades as a solution for the environmental problems inspired by the capacity of its sources (solar, wind, geothermal, hydropower, ocean energy, bioenergy, etc.) to replenish at a higher rate than they are consumed and not harming the environment (United Nations, 2023). The evolution of the renewable energy sector within the EU during the last three decades is impressive, the renewable energy production increasing between 1990 and 2019 from 12.6 % to 36.4 % (European Commission, 2022). Yet the share of renewables and biofuels in the gross inland consumption in 2019 was only 15.8 %, higher weights being registered by the oil and petroleum products (34.5 %) and natural gas (23.1 %), while nuclear and solid fossil fuels accounting for 13.5, respectively 11.6 %, due mainly to the fuel imports (of which 99.3 % were represented by oil and petroleum products, natural gas, and solid fossil fuels) weighting for 62.52 % in the total of gross inland consumption. Just to complete the landscape of the EU renewables and biofuels sector in 2019, the main sources of energy production were represented by biofuels and renewable waste (accounting for 59.3 %), wind (13.7 %), water (12.0 %), ambient heat (heat pumps, 5.4 %), solar photovoltaic (4.5 %), geothermal (3.0 %), solar thermal (2.0 %), and the remaining (slightly above 0.00 %) by tide, wave, and ocean (European Commission, Directorate-General for Energy, 2021).

The literature approaching the area of sustainable development in connection to the energy sector has taken into consideration the three classical dimensions of the subject paying significant attention to the related macro and microeconomic, and, more recently, social aspects. As economic growth is one of the most desirable outcomes of sustainable development, the observation made by Stern and Kander (2012) investigating Swedish data for 200 years, according to which the abundance of energy services is one of the driving forces for economic growth may represent a solid base for researching the connections between the energy, particularly the renewables and biofuels, and the economic dimension of the sustainable development. Yagi and Managi (2023) pointed out that higher energy prices mean higher costs across the entire supply chain and estimated that a price increase of 20 % in the energy sector worldwide would increase prices in all sectors by 3.15 % and decrease monthly GDP by 6.83 %.

Studying macroeconomic indicators to determine the interactions between the development of renewable energy, economic growth, and sustainable development, Lyeonov (2019) has proved that green investments determine a 6.4 % increase in GDP and a corresponding 3.08 % decrease in greenhouse gas emissions, while Jebli et al. (2020) have found several long and short-term bidirectional causalities between renewable energy consumption and CO_2 emissions, service value-added, and economic growth. Güney

(2019) has concluded that renewable energy usage has a positive impact on sustainable development not only in developed, but also in developing countries, and Güney (2021) measured a direct correlation between the consumption of renewable energy and the sustainable development in high-income countries observing that when consumption increases by 1 %, the level of development improves by 0.326 %, while when the consumption decreases by 1 %, the level of development decreases by 1.004 %.

Several studies suggested that the countries' level of income affects the impact of renewable energy, the positive effects of renewable energy consumption on the economy being more visible statistically in the high-income countries than in the lower and middle-income countries. Al-Mulali et al. (2013) showed that 79 % of the countries have a positive bi-directional long-term relationship between renewable energy consumption and GDP growth, the relationship being more persistent and significant in higher-income countries. Jebli et al. (2020) have added that there is no connection between renewable energy consumption and economic growth, industry and services value-added, and CO_2 emissions in low and middle-income countries. In exchange, Ahmed and Shimada (2019) have observed that in countries with high investments and established policies, already advanced in their transition toward renewable energy, the renewables sector has a positive impact on economic growth. Thus, in a high-income country, such as Finland, the consumers are optimistic and somewhat involved in the energy transition, even though they expect the public sector or government to take the initiative (Vainio et al., 2019), while in an upper-middle-income country, such as Montenegro, even with positive perceptions and attitudes, respectively awareness and knowledge regarding renewable energy sources, utility, and costs appear to have an even higher priority level when making decisions regarding energy consumption (Djurisic et al., 2020).

Although the microeconomic aspects of the transition to green energy were less studied, the importance of consumers' support for the transition to renewable energy and shaping a sustainable economy and society is essential due to the fact that two-thirds of consumption-based global emissions are linked to private households. Supporting the EU's efforts toward a climate-neutral continent, the consumers should acknowledge specific values, have access to clean energy with accessible prices, and assume supporting behaviors like consuming less energy, becoming active consumers or prosumers, becoming more aware of energy issues and the impact of their own behaviors, responding to energy demand, participating to efficiency schemes, etc. (Eerma et al, 2022). Energy literacy, with its three dimensions – knowledge (understanding the basic concepts), attitude (assuming opinions, convictions, and ideologies based on the knowledge), and behavior (acting specifically based on the knowledge and attitude) could play a key role in the adoption of sustainable energy consumption habits (Martins et al., 2019). Also, Masrahi et al. have found that all three factors of the theory of planned behavior – subjective norms, descriptive norms, and personal moral norms – accompanied by the willingness to pay are influencing consumers' intentions to shift towards and use renewable energy.

The EU consumers have been exposed to multiple changes in a sector aiming to make the green transition aiming to reach the objectives of developing renewable energy, protecting the environment, guaranteeing reasonable energy prices for consumers, and fighting global warming, their overall behavior being influenced by different factors such as psychological, social, and cultural (Janik et al., 2021), environmental (Karasmanaki and Tsantopoulos,

2021), political (Stadelmann-Steffen and Eder, 2021), and demographic (Balta-Ozkan and Le Gallo, 2018) factors. Analyzing the impact of getting consumers involved in the transition to renewable energy sources in Germany, Eerma et al. (2022) have concluded that transition would be possible if investments are made, the economy is transformed, a favorable regulatory, social, and economic framework is created, and educational policy measures are taken, all having as background the overall favorable attitude toward the process.

The transition process should not avoid taking into consideration the drawbacks of renewable energy sources, such as their unstable condition determined by the dependence on weather conditions (Sinn, 2017) or the lack of capacity to ensure the security of the energy supply (Johansson and Turkenburg, 2004), but these limits could maybe overcome by shifting the timing of their consumption or by allowing a third-party actor to control the devices in order to ensure electricity demand flexibility and accommodate the use of unpredictable renewable energy sources, especially if that would mean decreasing the bills or helping the environment (Immonen et al., 2020).

In connection to the social dimension of sustainable development, the views range from a positive to a non-existent impact: there are studies suggesting that social equity is improved when renewable energy usage increases (Chapman et al., 2021; Fraser et al., 2023), while others suggest that renewables have no positive impact on social equity (Johnson et al., 2020) because regardless of the type of energy sources they use, disadvantaged groups of consumers will prioritize saving money by using less energy instead of living comfortably (Tong et al., 2021). Equity problems related to renewable energy are addressing disparities determined by gender, poverty, rural or marginalized communities (Johnson et al., 2020), and disparities by income and race that appear to be present not only in marginalized but also in large communities (Tong et al., 2021). Achieving social equity in the transition process to renewable energy sources depends on the baseline human development indicators and the level of income in each country (Fraser et al., 2023).

Although the transition to renewable energy sources depends on several entities, such as governments, lobbyists, technical experts, non-government organizations, and public opinion (Pannarello and Gatto, 2023), the consumer should stand in the center of attention at least if it is to design, plan and conduct the process from a market-oriented perspective. European Commission initiated several studies to investigate citizens' opinions on European Energy Policy. According to the Eurobarometer 492 (European Commission, 2019), most European consumers (41 %) understand that EU energy policy means "shifting from fossil fuels to renewable energy sources to combat climate change", "decreasing energy consumption" (28 %), "more competitive prices" (27 %) or "contributing to economic growth and employment by investing in innovative technologies" (24 %). A special focus is placed on the awareness, understanding, and impact of energy labels, with 93 % of European consumers seeing it, 79% knowing what it stands for, and 79 % being influenced by it when purchasing appliances. Analyzing the results of Eurobarometer 492, Pannarello and Gatto (2023) suggested that Northern and Western EU countries are likely to take the lead in the process of energy policy transition as the oldest, respectively more prone to support green initiatives, last but not least, wealthier countries, while the Eastern and Southern countries seem to delay process due

to the economic stagnation, specific national attitudes and political orientations undermining this transition.

2. Methodological notes

Under a context in which the macroeconomic perspective on renewable energy and sustainable development has been investigated significantly more than the microeconomic one, this exploratory market-oriented study is focused on three main concepts and their interactions: the status and transition to renewable energy, their connection to sustainable development, and European consumers' attitudes and behaviors regarding the transition and their contribution.

In order to assess the relationships between the transition to renewable energy, sustainable development, and the European consumers' related attitudes and behaviors, a set of 15 research variables has been employed:

- %REN: share of renewable energy in gross final energy consumption (as a percentage);
- RENPro: renewables and biofuels energy supply (in thousand tons of oil equivalent);
- RENCon: renewables and biofuels final consumption (in thousand tons of oil equivalent);
- EUA_CE: attitude of the European consumers toward the necessity that the EU to ensure access to clean energy (as a percentage);
- EUA_RE: attitude of the European consumers toward the necessity that the EU to be responsible for encouraging more investment in renewable energy expressed (as a percentage);
- EUA_LC: attitude of the European consumers toward the necessity that the EU to be responsible for empowering cities and local communities to move towards clean energy (as percentage);
- EUA_IN: attitude of the European consumers toward the necessity that the EU should tackle investment in and developing clean energy technologies as a priority over the next ten years (as percentage);
- GDPc: real Gross Domestic Product per capita (in Euro);
- INC: mean income per capita (in Euro);
- EMPrate: employment rate of adults 18-64 years old (as percentage);
- EDU 3-8: share of the population having upper secondary, post-secondary non-tertiary, and tertiary education (as percentage);
- SocEX: share of persons at risk of poverty or social exclusion (as percentage);
- UNemp%: unemployment rate (as percentage);
- GGE: Greenhouse gas emissions (in million tons);
  FORR: Land surface covered by forests (in square kilometers).

In order to avoid the exceptional perturbations generated by the recent coronavirus pandemic and the war in Ukraine, the research approach has employed 2019 data for the investigated variables from the Eurostat categories of Economy and Finance,

Population and social conditions, and Environment and energy, respectively The World Bank Data Bank – World Development Indicators (serving as a complementary source of information). Pearson correlation coefficients and coefficients of determination have been calculated using JASP, an open-source project supported by the University of Amsterdam, and employed to assess the relationships between the variables describing renewable energy, sustainable development, and related consumers' attitudes.

3. Main findings

In 2019, the EU countries produced energy using renewables and biofuels of 253991.016 thousand tons of oil equivalent and consumed renewables and biofuels energy of 110297.083 thousand tons of oil equivalent. More or less surprisingly, the share of the final consumption in the total energy supply was of only 43.43 %, with the EU countries grouped in three main categories: Cyprus (80.10), Poland (72.56), Czechia (65.97), Hungary (65.25), Malta (64.17), Romania (63.73), Bulgaria (57.70), Latvia (56.89), Slovakia (56.12), Slovenia (56.11), Finland (55.30), Croatia (53.94), Greece (53.68), France (52.02), and Luxembourg (50.64) with shares above the average, Austria (39.86), Belgium (44.74), Lithuania (45.60), and Portugal (47.92) around the average, respectively Denmark (27.28), United Kingdom (28.21), Ireland (29.81), Netherlands (36.60), Spain (36.72), Germany (36.74), Italy (36.98), Estonia (37.56), and Sweden (38.34) below the average.

In 2019, the share of renewable energy in the total final energy consumption of the EU countries was 22.03 %, with these countries grouped in three categories: Sweden (55.78), Finland (42.80), Latvia (40.92), Denmark (37.02), Austria (33.75), Estonia (31.73), Portugal (30.62), Croatia (28.46), Lithuania (25.47), Romania (24.29) with shares above the average, Luxembourg (7.04), Malta (8.23), Netherlands (8.88), Belgium (9.92), United Kingdom (11.40), Ireland (11.97), Hungary (12.63), Cyprus (13.77), Poland (15.37), Czechia (16.23), Slovakia (16.86), France (17.17), Germany (17.26), Spain (17.85), Italy (18.18), Greece (19.63) below the average, and only Bulgaria (21.54) and Slovenia (21.96) near the average.

Transition to renewable and green energy involves strong support from the part of the consumers. As the results of the Special Eurobarometer 492 show, this support is significant as 90 % totally agree that „the EU must ensure access to clean energy e.g. encourage a move away from fossil fuels towards energy sources with low greenhouse gas emissions", 90 % totally agree that „it should be the EU's responsibility to encourage more investment in renewable energy e.g. wind, solar", 89 % totally agree that „it should be the EU's responsibility to empower cities and local communities to move towards clean energy". Last but not least, almost half (47 %) of the consumers agree that EU should tackle investing in and developing clean energy technologies as a priority over the next 10 years".

Although the overall context, particularly the attitude of European consumers, seems to favor an extensive and faster adoption of clean and green energy technologies, the relationships between renewable energy and the economic, social, and natural dimensions of sustainable development describe associations that are of low or even very low intensity and not statistically significant.

Table 1. The correlations between the production, consumption, and share of renewable energy, dimensions of sustainable development, and related consumers' attitudes.

Pearson's Correlations ▼

Variable		%REN	RENPro	RENCon	EUA_CE	EUA_RE	EUA_LC	EUA_IN	GDPc	INC	EMPrate	EDU 3-8	SocEX	Unemp%	GGE	FORR
1. %REN	Pearson's r	—														
	p-value	—														
2. RENPro	Pearson's r	0.065	—													
	p-value	0.742	—													
3. RENCon	Pearson's r	0.072	0.958***	—												
	p-value	0.716	< .001	—												
4. EUA_CE	Pearson's r	−0.137	−0.010	−0.078	—											
	p-value	0.485	0.958	0.694	—											
5. EUA_RE	Pearson's r	−0.084	−0.073	−0.130	0.941***	—										
	p-value	0.672	0.710	0.510	< .001	—										
6. EUA_LC	Pearson's r	−0.228	−0.077	−0.102	0.755***	0.801***	—									
	p-value	0.244	0.697	0.607	< .001	< .001	—									
7. EUA_IN	Pearson's r	0.255	0.254	0.198	0.521**	0.464*	0.098	—								
	p-value	0.189	0.193	0.313	0.004	0.013	0.619	—								
8. GDPc	Pearson's r	−0.103	0.150	0.073	0.184	0.220	−0.059	0.511**	—							
	p-value	0.602	0.447	0.711	0.349	0.260	0.766	0.005	—							
9. INC	Pearson's r	−0.012	0.294	0.208	0.208	0.215	−0.102	0.596***	0.937***	—						
	p-value	0.954	0.128	0.289	0.287	0.272	0.606	< .001	< .001	—						
10. EMPrate	Pearson's r	0.194	0.036	−0.035	−0.098	−0.196	−0.263	0.023	0.073	0.162	—					
	p-value	0.324	0.857	0.861	0.620	0.317	0.176	0.908	0.711	0.410	—					
11. EDU 3-8	Pearson's r	0.163	−0.141	−0.076	−0.303	−0.345	−0.179	−0.201	−0.135	−0.136	0.371	—				
	p-value	0.408	0.476	0.699	0.117	0.072	0.362	0.304	0.495	0.490	0.052	—				
12. SocEX	Pearson's r	0.027	−0.092	−0.115	−0.228	−0.172	−0.086	−0.256	−0.360	−0.449*	−0.356	−0.255	—			
	p-value	0.892	0.640	0.560	0.242	0.382	0.665	0.189	0.060	0.016	0.063	0.190	—			
13. Unemp%	Pearson's r	0.100	0.089	0.081	0.350	0.378*	0.366	0.352	−0.055	−0.082	−0.705***	−0.391*	0.389*	—		
	p-value	0.612	0.653	0.681	0.068	0.047	0.055	0.066	0.780	0.680	< .001	0.040	0.041	—		
14. GGE	Pearson's r	−0.274	0.903***	0.877***	−0.031	−0.097	−0.025	0.065	0.059	0.169	−0.007	−0.098	−0.049	0.010	—	
	p-value	0.158	< .001	< .001	0.874	0.625	0.901	0.743	0.765	0.389	0.971	0.618	0.803	0.961	—	
15. FORR	Pearson's r	0.536**	0.601***	0.688***	−0.016	−0.025	−0.132	0.396*	0.040	0.121	0.001	0.007	−0.026	0.238	0.334	—
	p-value	0.003	< .001	< .001	0.935	0.900	0.503	0.037	0.840	0.539	0.994	0.971	0.895	0.222	0.082	—

* p < .05, ** p < .01, *** p < .001

Data sources: Eurostat, The World Bank.

The EU's involvement in ensuring extended access to clean energy correlates positively, but not statistically significant, to the economic dimension of sustainable development. The European consumers, particularly those in the countries with a higher GDP per capita and income, expect a greater involvement, suggesting that both the public authorities, at national, regional, and local levels, and the individuals have the economic, mostly financial, resources to support this involvement.

The EU's involvement in ensuring extended access to clean energy correlates, yet not statistically significant, with a single variable describing the social dimension of sustainable development suggesting that greater involvement may reduce social exclusion to a certain extent. Surprisingly, greater involvement correlates negatively and not statistically significantly with the employment rate and level of education suggesting that clean energy technologies are less work-intensive and a higher level of education generates a critical view on the subject. Even more surprisingly, greater involvement correlates positively, but not statistically significant, with unemployment suggesting that clean energy technologies may increase the specific rate and affect overall employment.

The EU's involvement in ensuring extended access to clean energy correlates poorly, negatively, and not statistically significant with the variables describing the natural dimension of sustainable development. A greater involvement could contribute, but not significantly, to a slight decrease of greenhouse gas emissions without necessarily reflecting in a cleaner and greener environment, at least not in terms of the FORR…

The EU's responsibility to encourage more investment in renewable energy follows the

same patterns as the involvement in ensuring extended access to clean energy in terms of the correlations with the variables describing the economic, social, and natural dimensions of sustainable development: positively, but not statistically significant with the economic dimension, negatively, but not statistically significant with the three out of four variables of the social dimension, and poorly, negatively, and not statistically significant with the natural dimension. The exception from the pattern is represented by the correlation with the fourth social dimension variable considered suggesting that an increased EU responsibility to encourage investments in renewable energy could impact significantly unemployment by increasing its rate and reconfirming the perception that clean energy technologies are less work-intensive.

Although the idea of empowering cities and local communities to move towards clean energy sounds very promising, an increased responsibility of the EU in this respect has a less favorable impact from the perspective of sustainable development, particularly in terms of economic development, being associated with the potential slight decreases of the GDP per capita, respectively income of the individuals. A possible explanation of this attitude is represented by a certain fear that the costs of this movement will be supported by the economies of the Member States and, in the end, by the European consumers. More, this empowerment will not improve the social dimension – having the same negative and not statistically significant effects over the employment rate, level of education, social exclusion, respectively positive (in mathematical sense), yet negative (in social sense) over the unemployment rate – nor the natural dimension – with the same negative and not statistically significant effects over the land covered with forests, respectively negative (in mathematical sense), yet positive, but very poor (in natural sense) – of the sustainable development.

According to European consumers, investing in and developing clean energy technologies is the main priority the EU should tackle over the next ten years. This will generate favorable effects in terms of the economic dimension of sustainable development associating positively and statistically significant with the GDP per capita and income suggesting that increased investment and development of clean energy technologies will determine corresponding favorable evolutions at macro (increase of the gross domestic product) and microeconomic (increase of the individuals' income) levels, and, reciprocally, a higher GDP per capita, respectively individual income, will provide the economic, mostly financial resources to support further investment, development, and, most important, employment of the clean energy technologies.

From the perspective of the social dimension of sustainable development, the most favorable outcome of prioritizing the investment and development of clean energy is represented by the trends of diminishing social exclusion and increasing the employment rate, although the correlations are poor and extremely poor, and not statistically significant. The balance relationships between the investment and development of clean technologies and the level of education, respectively the unemployment remains a significant problem as, on one hand, a higher level of education, and, on the other hand, a higher unemployment rate tends to be associated with a lower prioritization of the clean energy technologies' investment and development. Another important, positive, and statistically significant effect of the clean energy technologies prioritization is the improvement of the natural environment in terms of the land covered by forests, while another favorable aspect

is represented by the extremely poor but positive, although not statistically significant correlation between the prioritization and the greenhouse gas emissions the attitude being more favorable where the emissions are higher.
Analysis of the relationships between the attitudes of the European consumers, expressed through the role of the European Union in ensuring access to clean energy, its responsibilities to encourage more investments in renewable energy and to empower cities and local communities to move towards clean energy, and, last but not least, to prioritize investment and development clean energy technologies, and the production and consumption of the renewable energy, respectively the share renewable energy in gross final energy consumption, reveals a rather reserved present, but a more promising future.
The rather reserved present is illustrated by the very poor, negative, and not statistically significant correlations between the role and responsibilities of the European Union in ensuring access to clean energy, encouraging investments in renewable energy, empowering the cities and local communities' movement towards clean energy and the production and consumption of the renewable energy reflected in the share of renewable energy in gross final energy consumption. A more favorable attitude tends to characterize the Member States where the production, consumption, and share in the final energy consumption are lower.
This opens favorable perspectives as, on one hand, a more favorable attitude of the consumers creates a more supportive background and, on the other hand, the European consumers consider that investment and development of clean energy technologies must represent an EU priority for the next decade.

4. Conclusions, limits, and further directions of the research

Three main conclusions can be drawn based on the results of this exploratory approach. First states that transition to the renewable energy represents an important opportunity to be seized by the EU Member States opening two significant directions of development balancing between the traditional and renewable energy sources, respectively production and consumption of renewable energy. As, on the one hand, the traditional energy sources continue to represent an important part in the overall energy supply but, on the other hand, the shift to cleaner and greener energy sources becomes more and more necessary, each Member State, as well as the EU as a whole, will have to approach the transition considering the coexistence of traditional and renewable energy from a strategic perspective. In terms of sustainable development, this coexistence will have to balance organically the concerns regarding the environment (mostly the scarcity of fossil fuels and the negative effects generated by the production and consumption of traditional energy), economic (mostly the costs of energy production and the final industrial and domestic energy consumption), and, last but not least, social (mostly the employment and social inclusion) dimensions. Under this organic vision, "coexistence" is a more accurate term than "transition" to describe the content of the process considering the nature of the traditional and renewable energy as well as the outcome of the process, which may result into integration in terms of production and consumption aiming to balance the traditional sources and renewables by gradually reducing the share of the traditional energy sources (that are still accounting for important weight both in energy production and

consumption) while optimizing the economic, social, and environmental effects.
Second, there is strong support from European consumers for increasing the share of renewable energy in their day-to-day lives as around nine out of ten Europeans totally agree that the EU must ensure access to clean energy, has the responsibility to encourage more investment in renewable energy, and should be responsible to empower cities and local communities to move towards clean energy. Still, almost half (47 %) of the Europeans agree that the EU should tackle investing in and developing clean energy technologies as a priority over the next 10 years which may raise two questions: On the one hand, if it is not the EU, then whose priority is? On the other hand, does investing and developing clean energy technologies represent a priority for the next decade? It is important to notice that the Special Eurobarometer 492 identifies other concerns of the European consumers, that may become priorities of the EU in the next ten years, such as ensuring that "energy costs are as low as possible" (considered by 37 % of the consumers), stepping-up "international efforts to reduce the impact of energy on climate change" (33 %), "reducing overall energy consumption in the EU" (30 %), or providing the European consumers with "clear information to help them make better choices" regarding energy providers, appliances, savings, etc. (26 %). The consumers' support is a prerequisite, but not sufficient, being conditioned by how they know, understand, get involved, and participate actively in the process. Positioning, again organically, all the stakeholders in terms of their roles, participation, and sharing the benefits of the transition, where organic means that producers provide energy, consumers use it responsibly, and local, regional, national, and European authorities – in this order! – create the framework for the functioning of the energy market, is determinant of the outcome of the process.
Third, the relationships between production, consumption, and share of renewable energy and the economic, social, and environmental dimensions of sustainable development at the EU level are debatable, the exploratory research results indicating associations of poor or even very poor intensity and not statistically significant as well as confirming that traditional energy sources as still relevant for the European energy market. All these emphasize the need for an organic transition that will allow the gradual decrease of the share of the traditional sources in energy production and consumption and their balanced replacement with renewables without affecting or impacting minimally the economic, social, and environmental dimensions of sustainable development.
The first important limit of the research refers to the set of variables considered to illustrate the economic, social, and environmental dimensions of sustainable development as these dimensions are too complex so that only eight variables (two economic – real gross domestic product per capita and mean income per capita, four social – employment rate of adults 18-64 years old, share of the population having upper secondary, post-secondary non-tertiary, and tertiary education, share of persons at risk of poverty or social exclusion, and unemployment rate, and two environmental – greenhouse gas emissions and land surface covered by forests) to be enough in order to describe each dimension and the overall content of sustainable development. Besides the number, the relevancy of the considered variables may also be debated in terms of their adequacy to express and quantify the relationships between renewable energy and the specific dimensions of sustainable development.
The second limit refers to the static landscape generated using the data referring to a single

year, 2019. As the transition from traditional to renewable energy sources supposes a process of adoption and integration that extends over a longer period, the assessment of the connections between renewable energy, sustainable development, and the related consumers' attitudes should be conducted on a longer period of time to identify and assess the evolution of balance between the traditional and renewable energy sources, respectively the dynamic replacement of the fossil fuels – oil, natural gas, and coal – by the renewables and biofuels, as well as the evolution of the internal structure within the renewables sector, respectively the dynamic changes of weights of its specific categories – biofuels and renewable waste, wind, water, ambient heat (heat pumps), solar photovoltaic, geothermal, solar thermal, and tide, wave, and ocean.

A third limit may be represented by the group of countries considered for this exploratory research. The overall level of economic, social, and environmental development, a relative homogeneity (in terms of positioning towards energy-related matters, not necessarily in connection to the renewable energy share in the total of the final gross consumption), and, last but not least, the availability of the statistical data, make the EU Member States a relevant sample of observation units. Yet, the conclusions and their potential extrapolation to other countries or groups of countries are debatable and may serve only as a reference for conducting similar studies. Besides this, the weights held by the EU in the World's energy production, supply, and total final consumption recommend the extension of the group of investigated countries including China, the United States, and several countries from Asia and the Middle East.

There are at least three future directions of research. First aims to transform the approach from a transversal into a longitudinal one by extending the time in order to allow a quantitative measurement of the transition from traditional towards renewable sources within the energy production, consumption, and share of renewables in the total energy supply. The second aims to extend the number of research units enlarging the investigated group by including countries from other geographic areas. Finally, the third aims to expand the set of research variables to bring the approach closer to the marketing perspective on the subject covering all the components of the marketing macroenvironment (demographics, economic, cultural, political, technological, natural), and microenvironment (consumers, competitors, suppliers, and public) investigated in association with the variables describing the production, consumption, and share of renewable energy in the gross final energy consumption.

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