Renaissance

RENEWABLE INTEGRATION & SUSTAINABILITY
IN ENERGY COMMUNITIES

SURVEY REPORT

RENAISSANCE survey on renewable energies and community-based solutions

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1 PROJECT OVERVIEW

The RENAISSANCE project is an Innovation Action (IA) funded by the European Commission under the Horizon 2020 programme. RENAISSANCE aim is to deliver a community-driven scalable and replicable approach, to implement new business models and technologies supporting clean production and shared distribution of energy in local communities. In the first phase the Consortium collected data to identify stable and equitable business cases in four Local Energy Communities (LEC) across Europe. The resulting scenarios supported the co-design of the ReEnergise tool, which will help identifying the optimal configuration for integrated and decarbonised Local Energy Systems (LES).

The tool will be tested in each Pilot Site and followed by a financial viability assessment. Thereafter an innovative platform for the integrated management and value delivery across all actors will be implemented in each pilot and interoperability realised. As a consequence, the energy communities at demonstrator sites will be fully connected and the use of RES will likely increase beyond 27%.

In the last phase, the RENAISSANCE approach will be simulated under market conditions connecting 10 sites across the globe, to demonstrate its scalability and replicability potential.

"Renaissance project supports the shift from technology-driven approaches to consumer-driven approaches, fostering the activation of communities"

EXECUTIVE SUMMARY

Within the RENAISSANCE project context, in addition to technical and economic aspects, it is deemed essential to include an analysis of the social aspects that influence the acceptance of clean technologies and measures, including renewable energy generation technologies. Technologies that are technically and economically feasible in a given context may not be successfully implemented due to social resistance, lack of awareness of the technology, low engagement and so forth. This survey on social acceptance of potential end-users (pilot sites inhabitants, stakeholders, further energy market actors involved) has a two-fold role: it allows identifying end-users needs while also offering an initial set of information which can guide them through the energy transition process. Last but not least, the survey is a substantial part of the wider RENAISSANCE stakeholder engagement strategy, which includes several workshops, institutional events, video-interviews, webinars and gamified data collection.

LOCATE YOUR CAMERA ON THE QR CODES PROVIDED TO EXPLORE THE ANIMATED PROJECT PRESENTATION IN HTML AND THE LATEST NEWS ABOUT THE PROJECT

WHAT IS SOCIAL ACCEPTANCE?

Social or public acceptance is generally defined, as a positive attitude towards a technology or measure, which leads to supporting behaviour if needed or requested, and the counteracting of resistance by others.

1.1 Why a survey on the RENAISSANCE approach acceptance?

Renewable energy communities are going to be a reality in Europe soon, pushed by the recent Clean Energy Directive approved in late 2019. The EU Commission is showing an increasing commitment towards sustainability and several European projects are purposely focusing on direct consumers' engagement in the energy transition.
Connected energy communities are the key players in the RENAISSANCE project, which explores and tests in real-life conditions the innovative business models and technologies towards a prosumer-consumer future energy market.
The RENAISSANCE survey on **renewable energies and community-based solutions assesses European citizens** awareness and expectations concerning emerging business models in the energy market: Local Energy Communities (LECs) and Renewable Energy Communities (RECs).

WHAT ARE THE MOST RECENT UPDATES CONCERNING ENERGY COMMUNITIES IN EUROPE?

The directive "Clean energy for all Europeans" obliges Member States to ensure a more competitive, customer-centred, flexible and non-discriminatory EU electricity market with market-based supply prices. It strengthens existing customer rights, introduces new ones and provides a framework for energy communities of prosumers. Currently Member States are working on the transposition of the Directive into national regulations.

WHAT DOES "PROSUMER" MEAN?

In the context of renewable energies, a prosumer is someone that both consumes and produces energy, mainly based on distributed systems installed in households or within minigrid community networks.

1.2 Survey distribution

The **"Survey on social acceptance of RENAISSANCE solutions" assessed** the social aspects influencing the acceptance of renewables, including local energy generation technologies. Moreover, the survey **promoted** the awareness on renewable energy generation systems and on regulatory measures activated in the European Union to facilitate the energy transition. Its main objective is to compare awareness and acceptance levels and track how they change over time across different segments of respondents, distributed in European Member States. **To this aim the survey has been translated in 6 different European languages and its distribution was planned in three different phases of the project:**

- **FIRST RUN (May-June 2020):** a first version of the survey was distributed in early 2020 and it offered insights from the early stages of implementation of RENAISSANCE solutions. The results are presented in this report and they represent a baseline both for general awareness and acceptance of recent European energy directives and of the specific solutions proposed by RENAISSANCE.
- **SECOND RUN (November-January 2021):** the survey will be distributed a second time, this time focusing on the pilot sites stakeholders segment, especially local energy consumers, in order to assess if and how their attitude shows substantial differences compared to the full set of respondents. From this second set of answers the project will gain a consolidated overview of most relevant awareness and acceptance indicators, resulting not only in a validation of the engagement strategies put in place by the project, but more importantly how awareness and acceptance levels change over time.
- **THIRD RUN (end of 2021):** towards the end of the project the survey will be distributed once again to the wide public and to pilot sites stakeholders, to receive final insights about awareness and acceptance levels. Indeed, while on one hand respondents not directly involved in the project will likely show unvaried trends, on the other those participating in pilot sites activities and all other involved actors (ESG members, project's followers, researchers) will hopefully disclose higher levels of awareness and interest.

> 1.3 Survey design

We referred to Wüstenhagen et al.[1], and the 3 main sub-components of social acceptance, **forming the so-called "*triangle of social acceptance*"**:

- Community acceptance
- Market acceptance
- Socio-political acceptance

From the recent literature[2][3][4] we derived the most relevant aspects influencing social acceptance in all the 3 above-mentioned components.

Awareness

1. Awareness of environmental and energy problems (climate change, pollution, energy consumption, etc.)
2. Energy production and distribution issues perception
3. Knowledge of the technology/innovative business models and regulations
4. Efficacy of the technology/innovative business models and regulations

Local Context influencing decision making

5. Social norms and community influence (herding behaviour, are your neighbour/friends/colleagues/relatives in favour and/or adopting the technology?))
6. Facilitating conditions (public incentives/discounts)
7. Trust in decision-makers and other relevant stakeholders;
8. Fairness of the decision-making process

Individual factors influencing decision making

9. Perceived costs in implementing the technology
10. Perceived risks in implementing the technology
11. Perceived benefits and usefulness in implementing the technology

Acceptance and Adoption

12. Citizen acceptance: in favour of public innovations, collective implementation of technologies
13. Consumer acceptance: Intention to use and adopt the technology;

1 Wüstenhagen, Rolf, Maarten Wolsink, and Mary Jean Bürer. "Social acceptance of renewable energy innovation: An introduction to the concept." Energy policy 35.5 (2007): 2683-2691.

2 Polimp.eu - 1ST POLICY BRIEF June 2014 Acceleration of clean technology deployment within https://climatepolicyinfohub.eu/

3 The social acceptance of wind energy, Ellis Geraint, Ferraro Gianluca, JRC, 2016

4 Huijts, Nicole MA, Eric JE Molin, and Linda Steg. "Psychological factors influencing sustainable energy technology acceptance: A review-based comprehensive framework." Renewable and sustainable energy reviews 16.1 (2012): 525-531.

Starting from questionnaires developed by Moula, Munjur et al.[5], complemented also with additional questions[6][7] to cover all the dimensions above, we developed the following questionnaire to assess social acceptance of renewable energies and of innovative community-based production and consumption models.

Moreover, we refer directly to proceedings of Intergrid project, more specifically to their D1.4 Design of Consumer's Engagement Strategies , where the project identifies as a main barrier to citizens' engagement and acceptance the fact that users are not aware of how energy systems work and that providing such information in advance may contribute to device solutions for potential problems (Natural Resources, 2014).

source: https://www.comreg.ie/

5 Moula, Md Munjur E., et al. "Researching social acceptability of renewable energy technologies in Finland." International Journal of Sustainable Built Environment 2.1 (2013): 89-98.

6 http://unfccc.org.mk/content/FBUR/Climate%20change%20survey%20FBUR.pdf

7 https://www.questionpro.com/survey-templates/climate-change-awareness-survey-template/

> 1.4 Methodology

The online survey was distributed via the Survey Monkey platform. See 1.4.3 for details on the recruitment strategies used to build the sample.
The survey was composed of 47 questions, organised around the factor described in the section 1.3.
The survey presented 6 multiple-choice questions, 25 items requiring the respondent to declare the level of agreement on a 5-point Likert scale, 7 items that required the respondent to rank the order of perceived importance of elements and 9 open-ended response.
Example of items can be seen in the table below (TABLE 1).

Item Category	Example of item	Example of response
Multiple Choice	Among the following energy sources, please select the ones you think are renewable:	□ Geothermal □ Natural Gas □ Biofuels □ Biomass □ Hydroelectric □ Coal □ Oil □ Wind □ Nuclear □ Solar
Likert-Scale	"I would switch to renewable-only energy providers, if it would result in a slightly higher bill"	1-Very unlikely 2-Unlikely 3-Neither likely nor unlikely 4-Likely 5-Very likely
Ranking	Among the following risks, please rank the ones which would prevent you from switching to a renewable energy-only provider. from the most impactful (1st) to the least (5th):	[#] Hidden or unknown costs. [#] Too much hassle to switch. [#] Low maturity of service [#] Market resulting in lower quality of service. [#] Transparency issues and distributive justice.
Open-ended	Do you want to comment or add something concerning the above scenarios?	Free-text box

Table 1. Example of Items

5 Moula, Md Munjur E., et al. "Researching social acceptability of renewable energy technologies in Finland." International Journal of Sustainable Built Environment 2.1 (2013): 89-98.

6 http://unfccc.org.mk/content/FBUR/Climate%20change%20survey%20FBUR.pdf

7 https://www.questionpro.com/survey-templates/climate-change-awareness-survey-template/

8 https://integrid-h2020.eu/uploads/public_deliverables/D1.4%20Consumers%20engagement%20strategies.pdf last visited on 20/12/2020

The first part of the survey introduced the project and the aims of the survey as well as all the references to privacy policy, consent forms and GDPR compliance pages and information (Figure 1).

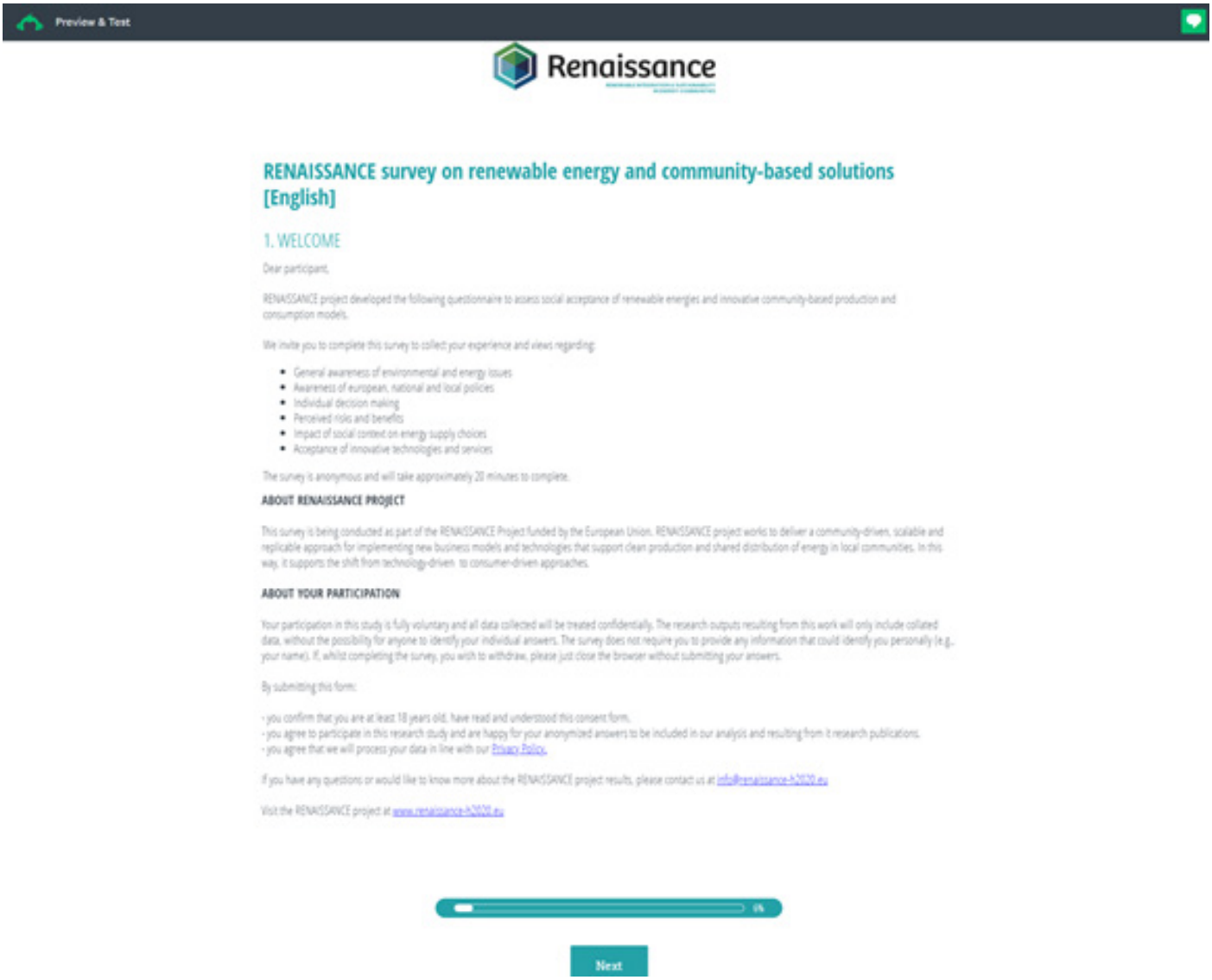


Figure 1. Example of the survey's User Interface.

The second section collected 10 socio-demographic variables (such as: gender, age, country, level of education and other background information, like household composition). This information was analysed in an aggregated and anonymised way, in order to cluster the response of the factors in the analysis part.
The third part of the survey would collect 9 questions about **the Awareness factor;** 10 questions about national and local policies; 3 on individual decision making; 7 on perceived risks and benefits; 3 on social context and 3 on acceptance; as well as final 2 questions on the communication channel that were used to contact the respondent.
All of the questions in the second and third part of the survey were mandatory, so the respondent could not proceed with the survey, if some item was not responded to. To partially mitigate this effect, the option "other" and open-ended questions were always inserted, to enable the respondent to express additional information or comments and integrate their responses.
The survey has been distributed in seven different European languages from 28th April 2020 until 31st July 2020. The sample size of the first run (See section 1.2) was N=212 respondents.
Additional information on the sample size will be detailed in the section 1.5.1.1 Background Information.
The plan for the statistical analysis is presented in section 1.5 Survey Analysis.

1.4.1 Expected Outcomes

The comparison between initial and final answers, collected among the different segments of respondents, will inform the project Consortium about the project success in terms of:

- Awareness level concerning renewables and energy communities
- Acceptance level concerning renewables and energy communities
- Customer engagement level linked to specific business models
- Overall assessment of the project dissemination strategy

Both citizens and energy stakeholders will benefit of the results. We strongly believe stakeholder engagement is truly efficient only if bottom-up flow of information is ensured, since it shortens the distance among the expert community and citizens. Indeed, it encourages the exchange of knowledge, needs and ambitions.

1.4.2. Target

This questionnaire was distributed across a wide basin of respondents:

- General audience
- Pilot sites stakeholders
- European citizens, entrepreneurs and industry representatives
- Consortium members' contacts and networks
- The scientific community of experts in the energy sector
- Decision makers and policy makers

In order to reach out for our targeted audience, 4 main groups were used as first points of contact:

- The European pilot sites stakeholders (inhabitants, enterprises and industry representatives, ESG members including policy experts via direct email)
- The International pilot sites stakeholders (inhabitants, enterprises and industry representatives, via promotional email)
- The Consortium members' contacts and networks (via direct e-mail)
- The project followers (via project website, newsletter and social media channels)
- The energy related online press agencies (press release)

Email networking

The invitation to participate to the survey was circulated broadly via a Mail Delivery Platform to all newsletter subscribers and within the Consortium.

Press release

In April 2020 a press release was circulated among project partners, who took care of translating and sharing the news with local press agencies and online news providers. The launch was also promoted via the EU research results platform Cordis.Europa.eu news section[9].

9 https://cordis.europa.eu/article/id/418036-renaissance-survey-on-renewable-energy-and-community-solutions-how-much-do-you-know-about-ren

Social media

To ensure widespread distribution of the survey we selected a set of hype keywords already used on social media when informing the audience about surveys or engagement activities about energy topics. A press-kit was developed using a recognizable graphic identity and QR codes have been provided for each translated version of the survey (Figure 2 and Figure 3).

Figure 2. LinkendIn promotional social card

Figure 3. Twitter promotional social card

> 1.5 Survey analysis

This section introduces the general Statistical Analysis Plan, together with the results of the statistical analysis. Depending on the nature of the variable considered, the data analysis process can be described as follows:

- **Calculate descriptive statistics for both independent (IV) and all dependent variables (DV).** More precisely the IV and IV considered for the different analysis are described in paragraphs: 1.5.1.2, 1.5.1.3, 1.5.1.4, 1.5.1.5, 1.5.1.6, 1.5.1.7 and 1.5.1.8.
- **For Independent variables:** split group on median split / quartile split will be performed, in order to reduce the levels for independent variables for inferential analysis. The main independent variables are described in the section 1.5.1.1 Background Information
- **For the variable to be ranked:** the Mode of the most frequent ranked position will be calculated
- **For the Multiple-choices answers:** frequencies will be calculated, along with Chi-Squared, analysis to assess the statistical significance of the difference in the observed cases, for different IV (median-splitted).
- **For the Likert scales: perform descriptive and inferential analysis:** General Linear Model (GLM), repeated measures on multiple dependent variables.
- The open-ended questions will be used to gain insight for the colcusions.

Details on the statistical analysis performed for each variables, together with the results, are presented in the 1.5.1.1- to 1.5.1.8 sections, while the Discussions are presented in Section1.6 and the Conclusions will be presented in Section 1.7.

1.5.1 BACKGROUND INFORMATION

The background information section collected information such as age, country of residence, level of education and socio-economic context.
The questions focused on aspects which could influence individual behaviour related to energy procurement. Namely age, income, level of education, residing country, population density of the surrounding area, and type of energy consumer have been identified as key factors.

Age and Gender

Age and Gender distribution of the respondent can be seen in Table 3, which shows that the overall sample covered gender in almost balanced way (42% Male, 57% Female, 1% Other). Age distribution presented more than 10 responders for each cell, and it reached almost the 50% percentile by responders younger than 34 years (cumulate percentage: 46%) while the rest of responders can be described as older than 34 years old (cumulate percentage: 54%). Thus, 35 years old will be used to split in two the independent variable "age" into equally distributed levels: Younger responders (<34 years old) vs. Older responders (>34 years old). It must be, then, noted that "older responders" in the context of the present research accounts mainly responders aged between 35 and 64 years old (cumulate percentage: 94%), while older than 65 years included in the "older responders" category, represent 6% of the overall sample. Age x Gender interaction did not produced an equally distributed categorisation X^2 (1, N=210) = 6.553, ρ = .010), lacking in male respondents older than 54 years old, compared to female responders of the same age-range. For this reason, when Gender and Age will be used as Independent Variables, the "Gender x Age" interaction effect will not be included in the Multivariate Model, but Age, recoded in two levels (younger vs. older responders), and Gender (Male vs. Female), as main effects only (Figure 2).

Age	Female	Male	Other Gender	Total Frequency	Percentage	Cumulative Percentage
18-24	7	13	1	21	10%	10%
25-34	39	37	1	77	36%	46%
35-44	29	24	0	53	25%	71%
45-54	19	7	0	26	12%	84%
55-64	16	7	0	23	11%	94%
65+	11	1	0	12	6%	100%
Total	121	89	2	212	100%	100%

Table 2. Age and Gender distribution

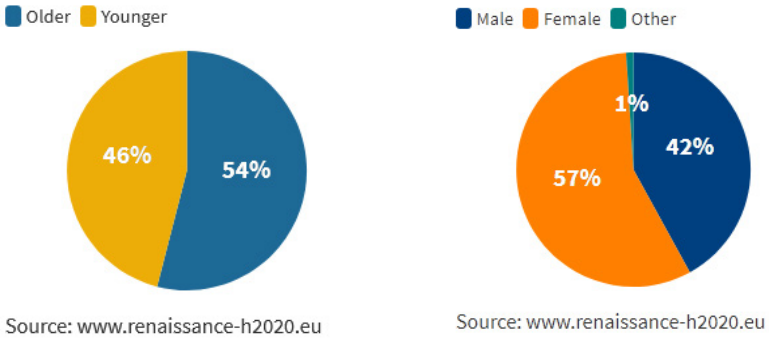


Figure 4. Age and Gender distribution

Education

Almost all respondents' education level varied between bachelor degrees' and PhD (Cumulative Percentage: 90%). More precisely "College diploma/Bachelor degree or higher" is, by far, the most frequent category (Mode: N=170), followed by "Doctorate" (N=20) and "Secondary school/Upper secondary" (N=18). No statistical differences were noted in the Gender x Education distributions X^2 (12, N=210) = 9.572, ρ = .653), as it can be seen in Figure 5.

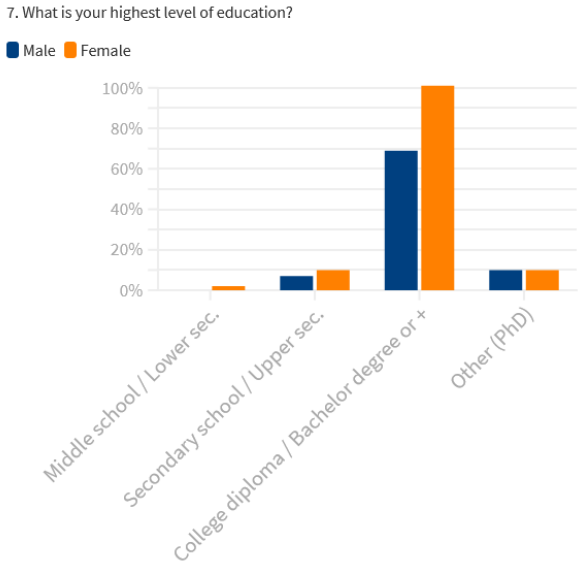


Figure 5. Gender x Education interaction

Type of consumers

The full sample was composed almost entirely by household consumers (Mode: N=128), tenants/ leasehold consumers (N=57) and landowner consumers (N=21): all categories with similar power behaviours. No industrial or commercial consumers participated in this first run of the survey (Figure 6).

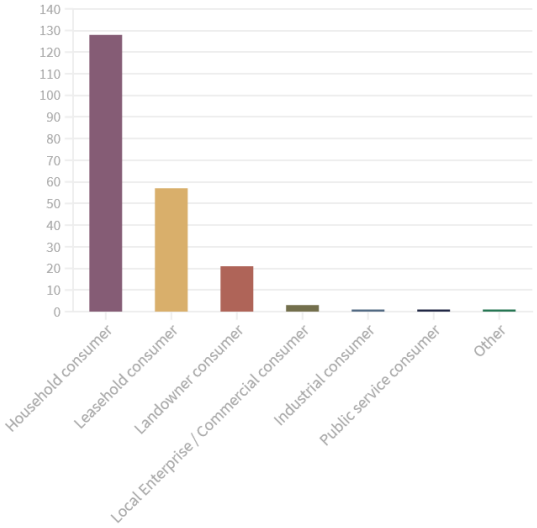


Figure 6. Among the following energy consumer types, which one best represents your current position?

Geographical Area

In terms of residing country, the geographical distribution of the responders is shown in Figure 7 a and 7b. Looking at the variance of the distribution, two main geographical groups could be identified (Table 3), since some degree of polarization emerged around topics related with policies awareness and perception of risks and benefits. The group hereafter called "Northern Group" (N=97) included respondents from Germany, The Netherlands, United Kingdom, Belgium, Switzerland, Poland, France. The group hereafter called "Southern Group" (N=114) included Albania, Slovenia, Hungary, Italy, Bulgaria, Portugal, Spain, Greece. It must be noted that it can not be possible within this resarch to determine wether this data-driven polarization depends directly on the difference between northen vs southern climatic areas, or if it is rather related with socio-economic conditions such as GDP pro capita. Most likely it is related with both, plus other complex motivations such as power-distance and trust in institutions and regulations. As it can be seen from Table 3, the geographical distribution of the respondent is not perfectly even by region and performing a t-test for unique sample, the two levels appear to differ significantly in distribution $t(211) = 45.515$, $p = .001$ (North < South). To allow inferential statistics, correction for homogeneity of the groups will be considered.

Figure 7a. Geographical distributions of respondents

Figure 7b. Geographical distributions of respondents

10 A slight correspondence with the two groups can be identified across countries with GDP pro capita below or above 35.000$ source: https://ourworldindata.org/grapher/average-real-gdp-per-capita-across-countries-and-regions?tab=table&time=2016..latest&region=Europe

Region	Country	Frequency
Northern	Poland	44
	Belgium	28
	The Netherlands	6
	France	5
	Germany	5
	Switzerland	4
	U.S.A.	2
	United Kingdom	2
	Hungary	1
	Total	97

Table 3. Geographical distributions by region

Region	Country	Frequency
Southern	Italy	51
	Spain	35
	Greece	19
	Portugal	3
	Bulgaria	2
	Slovenia	2
	Angola	1
	Albania	1
	Total	114

Table 3.1. Geographical distributions by region

Also, two groups based on the population density of the surroundings of living area were identified, since choices related to innovative solutions for renewable energy systems were plausibly expected to differ among high density areas and low to intermediate density areas.
The respondents live mainly in densely populated area (Mode: N=113) and intermediate density area (N=81), while the minority of the sample lives in thinly populated area (N=18).
In order to use "Density" as a two-level independent variable, the Intermediate and thinly populated areas categories were considered together in order to create an equally distributed variable: High Density (N=113) vs. Low Density (N=99) areas.

Income

Regarding the annual net income, the distribution of the Annual net income is represented in Figure 8. The most frequent category is represented by respondents with an annual net income between €15,000 and €29,999 (N=70). The 75% of the overall sample declare an Annual income net inferior to €50,000, while 11% of the sample prefer not to answer to this question.

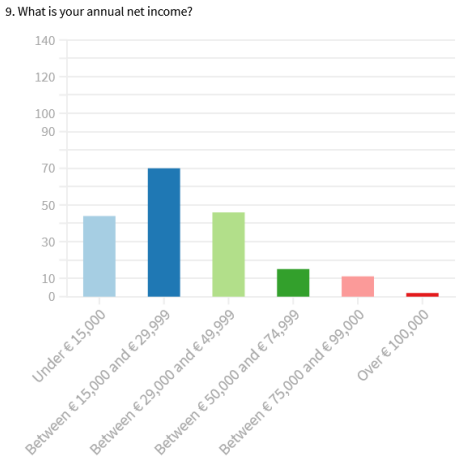


Figure 8. Annual net income

Current Knowledge of Renewable Energy

When asked to select, among a list, only the renewable energy sources, participants responded as visible in Figure 9. The most frequently selected Renewable Energy Source was "Solar" (N=193), followed by "Wind" (N=189), "Hydroelectric" (N=177) and "Geothermal" (N=160) that presented no ambiguous judgement by the overall sample (more than 75% of correct answers). On the other hand, "Biofuel" and "Biomass" were more controversial, as almost 50% of the overall sample considered them Renewable and 50% Non-renewable.
Finally, Nuclear, Natural Gas, Oil and Coil, were correctly identified as non-renewable energy sources by almost the entire sample.

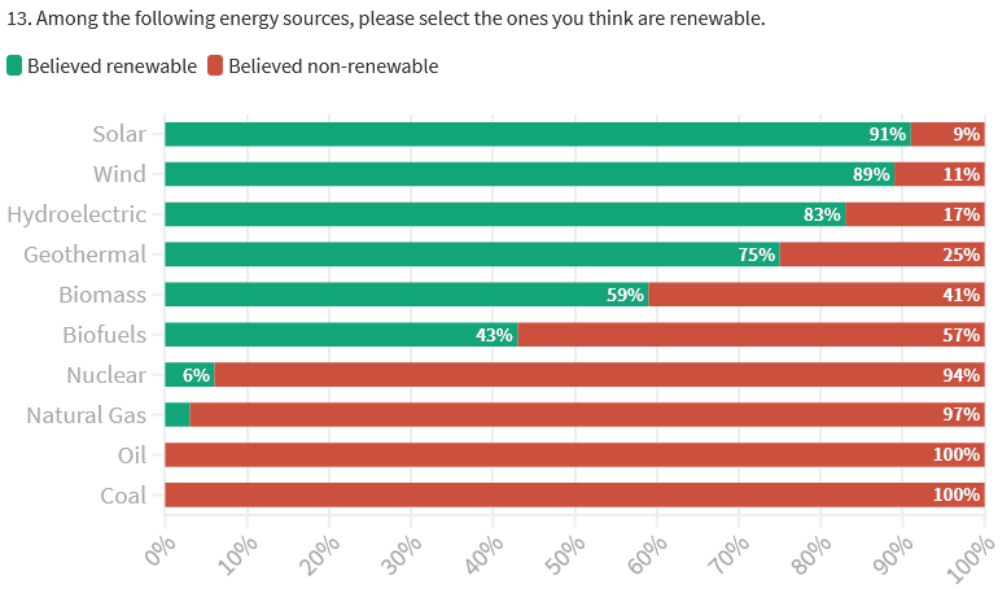


Figure 9. Current knowledge of Renewable Energy Sources

1.5.2. SECTION I – AWARENESS

The first section of the survey involved questions about awareness of the environmental issues, of the current incentives toward a more sustainable energy production model and the general awareness about renewable energies.

Concern of Global Issues

The first awareness-item asked to express, on a 5-point Likert scale, the concern about a list of global issues. The average concern for each global issue is shown in Figure 10. Climate change is considered, by far, the most concerning issue by the respondents (M=4.7, SD=1.0), followed by poverty (M=3.7, SD=1.3). A group with equally concerning global issues followed, composed by: Violence/War (M=3.5, SD=1.3), Economic situation (M=3.4, SD=1.1), Infectious Diseases (M=3.4, SD=1.3), Unemployment (M=3.3, SD=1.3), Overpopulation (M=3.0, SD=1.5). Finally, a group of less concerning global issue was identified by the respondent in: Terrorism (M=2.4, SD=1.4) and Crime (M=2.4, SD=1.4). It must be noted that the survey was launched before the COVID-19 pandemic.

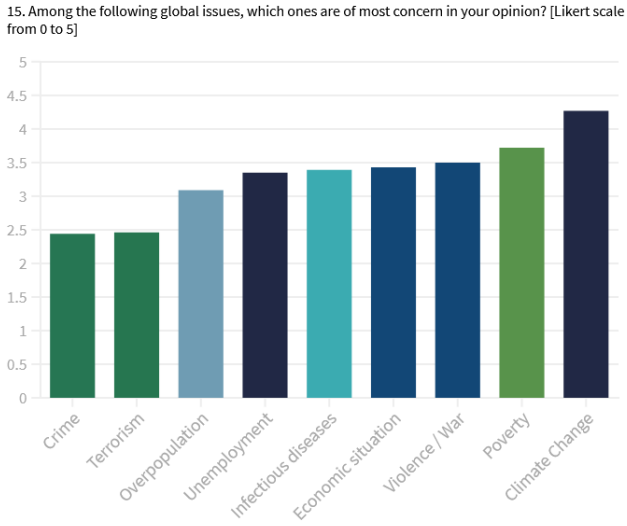


Figure 10. Average ranking of importance for global risks

A repeated multivariate analysis of variance (MANOVA) for Gender, Age and Geographical area was performed on the rating of Global Issues (9-level variable). The average difference in the concern demonstrated significant difference among the different issues, with Climate Change as being significantly considered more concerning than the other $F(8,179)=41.689$, $p=.001$, $\eta p^2=.196$. As it can be seen from Table 4, there were no significant differences in the concern among male and females $F(8,179)=.837$, $p=.570$, $\eta p^2=.005$ nor for younger and older respondents $F(8,179)=.519$, $p=.843$, $\eta p^2=.003$. However, significant difference in the concerns for global issues were found for Northern vs. Southern areas $F(6.8,179)=3.024$, $p=.004$, $\eta p^2=.017$.

Variables		df	F	Sig.	Partial Eta Squared	Observed Power
Global Issues	Assuming Sphericity	8	41.692	.000	.196	1.000
	Huynh-Feldt	6.825	41.692	.000	.196	1.000
Gender	Assuming Sphericity	8	.837	.570	.005	.397
Age	Assuming Sphericity	8	.519	.843	.003	.245
Geographical Area	Huynh-Feldt	6.825	3.024	.004	.017	.937

Table 4. Multivariate Analysis for Global Issues Variance

Partial Eta squared indicate a small significance, but looking at contrast analysis, it appears that Southern countries are more concerned compared to Northern countries to the following issues: Unemployment $F(1,179)=19.188$, $p=.001$; Economic Situation $F(1,179)=11.040$, $p=.001$; Poverty $F(1,179)=10.197$, $p=.002$; Infectious Diseases $F(1,179)=6.269$, $p=.013$; and also Climate Change $F(1,179)=4.289$, $p=.040$ (Figure 11). We assume such higher concern of the Southern Europe respondents derives from the actual harsher conditions in those Member States.

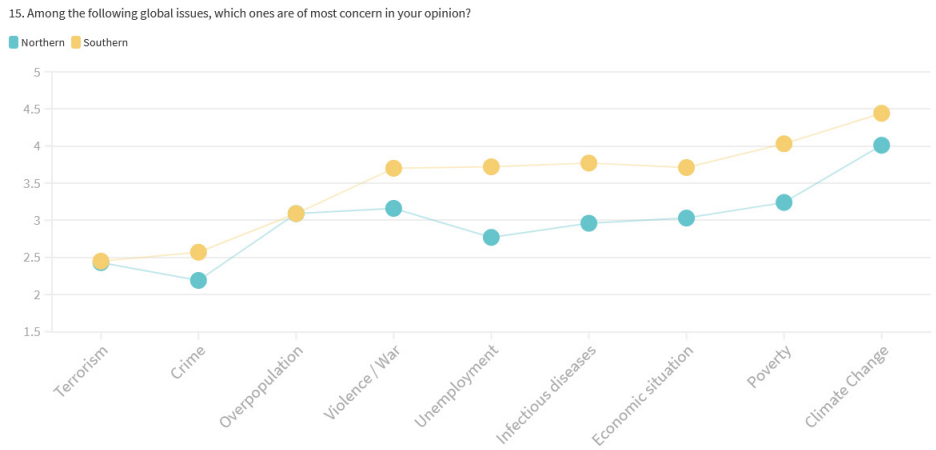


Figure 11. Global Issue concerns for Geographical Areas

NOTE

The survey was open from April 2020 until the end of July 2020, exactly in the middle of the first global wave of Covid-19 disease. Climate change and global violence were considered more important despite the huge impact of the pandemic bulletins and restrictions on people's daily lives. Further evaluation of the above indicators in the near future would allow a direct evaluation of how the level of concern changes across time.

Concern of Environmental Issues

The second item deepens the analysis looking at the environmental issues of most concern, asking the respondents to express their concerns on a series of specific environmental issue (Table 5).

				Cumulate Percentage		
	M	SD	Sum	25%	50%	75%
Rising of temperatures	4.31	.98	771	4.0	5.0	5.0
Air pollution	4.24	.84	759	4.0	4.0	5.0
Environmental resource exploitation	4.21	.86	753	4.0	4.0	5.0
Pollution of rivers and seas	4.21	.85	753	4.0	4.0	5.0
Loss of biodiversity	4.19	.95	750	4.0	4.0	5.0
Waste disposal	3.98	.94	713	3.0	4.0	5.0
Soil pollution	3.89	.95	697	3.0	4.0	5.0
Extreme weather conditions	3.85	1.04	690	3.0	4.0	5.0
Acidification of rain and oceans	3.59	1.06	642	3.0	4.0	4.0
Traffic congestions	3.35	1.06	600	3.0	3.0	4.0

Table 5. Environmental Issues rated as Most Concerning

A Repeated multivariate analysis of variance (MANOVA) performed for Gender, Age and Geographical area was performed on the rating of Environmental Issues (10-level variable). The average difference in the concern demonstrated significant difference among the different issues, $F(9,179)=29.275$, $p=.001$, $\eta p2=.146$. No statistical differences emerged for the Independent variables Gender, Age or Geographical Area (Table 6), meaning that no influence of such variables is present when considering environmental issues.

Variables		df	F	Sig.	Partial Eta Squared	Observed Power
Environmental Issues	Assuming Sphericity	9	29.275	.000	.146	1.000
	Huynh-Feldt	8.057	29.275	.000	.16	1.000
Gender	Assuming Sphericity	9	1.374	.195	.008	.674
Age	Assuming Sphericity	9	.417	.926	.002	.211
Geographical Area	Huynh-Feldt	8.057	.867	.544	.005	.413

Table 6. Multivariate Analysis of Environmental Issues Concerns

Considering the answers to the previous question about the global issues of most concern **(See "Concern of Global Issue"),** it was possible to divide the sample in respondents that presented high scores when evaluating their level of concern for Climate change vs. lower scores on the topic. The objective of this analysis is that of assessing if a different level of concern has any relevant influence on the perceived impact of current energy system on the environment and on the individual opinion about who should take the first steps towards the energy transition to renewables.
The "higher concern" group (HC) includes all the respondents who ranked as high importance the issue of climate change (N=152 respondents), while the "lower concern" group (LC) gave a low importance ranking to climate change (N=30 respondents). The numerosity of the two groups is unbalanced, so no inferential analysis was performed, yet this distinction was taken into consideration when presenting the results of the specific environmental issue concerns Descriptive Statistics (Figure 12).

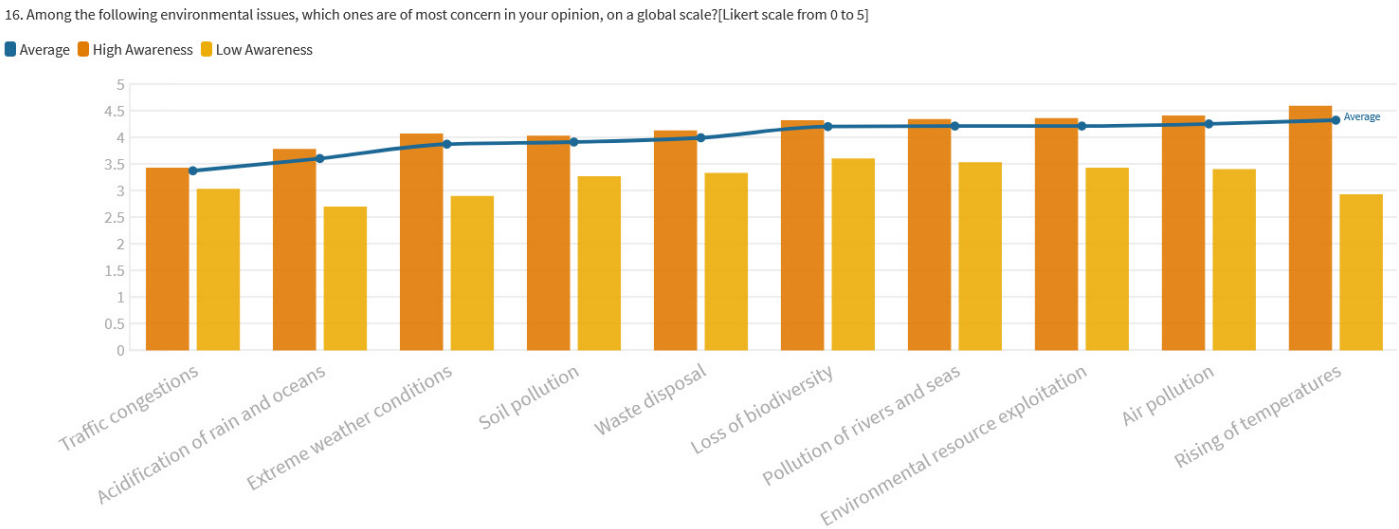


Figure 12. Average ranking of environmental issues of most concern – Q16

The most interesting differences between the two groups are visible in the level of concern related with Rising of temperatures, acidifications of rain and oceans, and extreme weather conditions. Such issues are considered by lc group less concerning than loss of biodiversity, pollution of rivers and seas and traffic congestion. The HC group, instead, selected the rising of temperatures as the most concerning environmental issues. Numbers suggest that projects, such as RENAISSANCE and scientific dissemination at large, do not only have to inform their target audience about specific topics or detailed research objectives: bridging knowledge and attempting correlations between different phaenomena (e.g. between acidification of rain and oceans, soil pollution and the extensive extraction

and use of fossil fuels) is an important responsibility to support a more holistic comprehension of our planet's complex echosystems.

Perceived impact of the current energy production model on the environmental issues

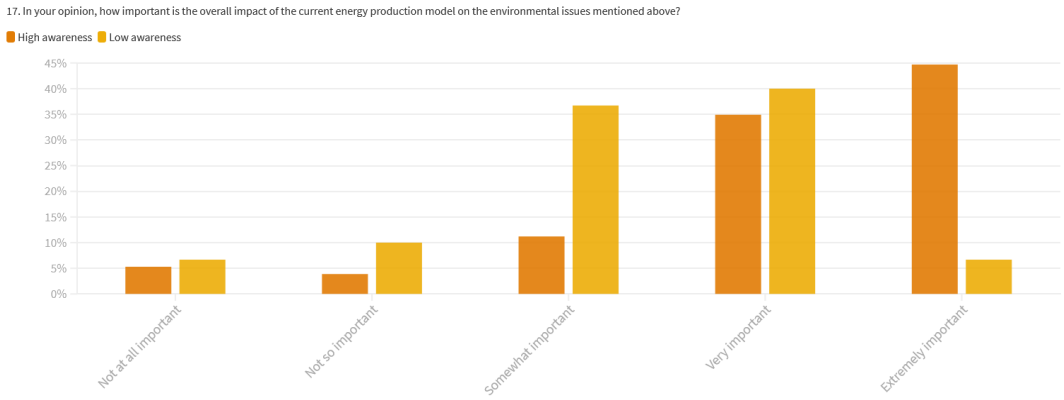


Figure 13. Perceived importance of the current energy production model on the environmental issues - Q17

When it comes to the perceived impact of energy production a polarization between the HC and LC responders emerges. Figure 13 shows how the level of concern about environmental issues influences perception: 44.7% of the HC group tend to believe that the production model is extremely important in impacting climate change, while only 6.7% of LC group tends to considers it as important. Nevertheless, the majority of respondents are aware that the production of energy has a strong impact on the environment, no matter how concerned they are.

USEFUL REFERENCES

https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en

First steps towards renewable energy production

As last question of this section, respondents were asked: "Who should take the first step towards renewable energy production models" (Multiple-choiche). Most respondents (141) answered that the national policy makers should be the firsts to commit for a more sustainable future, followed by energy producers (99) and regional policy makers (62), while the least are environmental groups and energy distributors.
Regulators (national and regional policy makers) are mentioned basically by 50% of the sample and together with energy producers they represent the 75% of the actors that are believed to be in charge taking the first steps. European regulators are paying more and more attention to the requests and needs of the stakeholders, especially those coming from the civil society and rely on the European research results and public consultations. This survey is confirming the expectations that citizens have on the regulatory bodies. Nevertheless, a large part of respondents expect energy producers to do their part, recognizing the responsibility of investors in that sense.

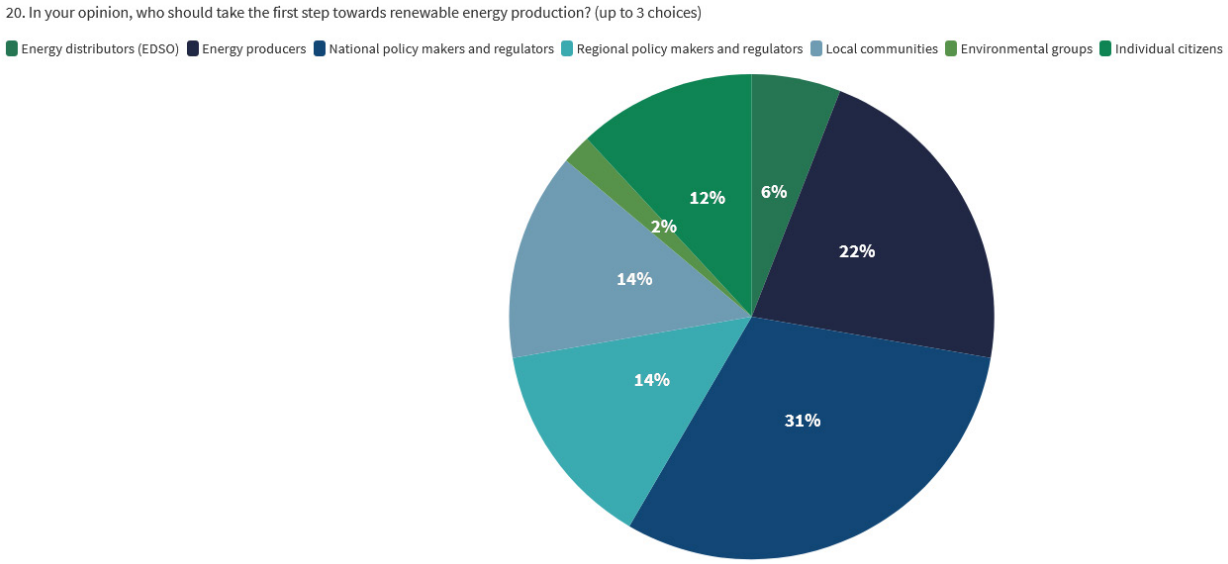


Figure 14. Who should take the first steps towards renewable energy production models – Q20

Analysing the answers of respondents belonging to differently populated areas (High Density N=113 vs. Low Density N=99) it is noticeable that people living in high density areas, consider the national policy makers hold larger responsibility compared to the people living in low density areas. The latter, on the other hand, gives more importance to the regional policy makers, even though, in absolute terms, this category is considered less important (Figure 15).

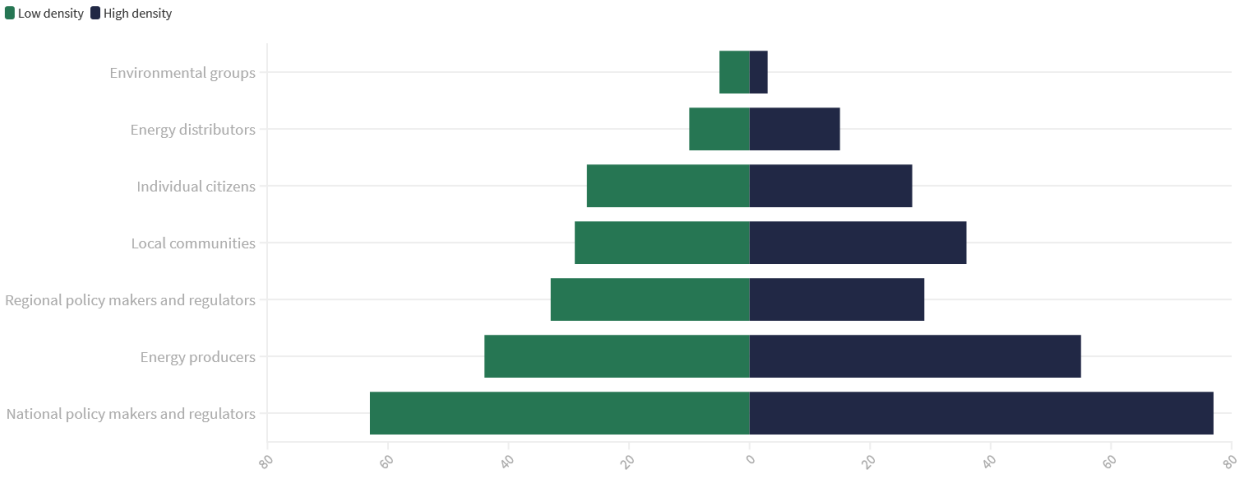


Figure 15. Actors considered responsible for taking first actions on sustainable models by population density

Conclusions

1. Despite the Covid-19 pandemic, Climate Change is the most concerning global issue.
2. Respondents with lower concern of Climate Change, rank the pollution of soil and water, notably caused by human activities, as the environmental issues of most concern.
3. The majority of respondents are aware that the production of energy has a strong impact on the environment, no matter how concerned they are about the environmental issues.
4. The majority of respondents think that first Policy Makers and Energy Producers should take the first steps in the energy transition.
5. People living in rural areas do expect more impactful action from regional policy makers, while people living in higher density areas rely more on National bodies.

source: https://www.pexels.com// || author: Rodolfo Clix

1.5.3. SECTION II – LOCAL, NATIONAL AND EUROPEAN POLICIES

The section II of the survey focuses on the awareness about existing incentives and facilitating measures both at the national and local level. **The aim was find out if there is a gap between the current policies and the level of awareness of citizens about their existence.**

Local Initiatives

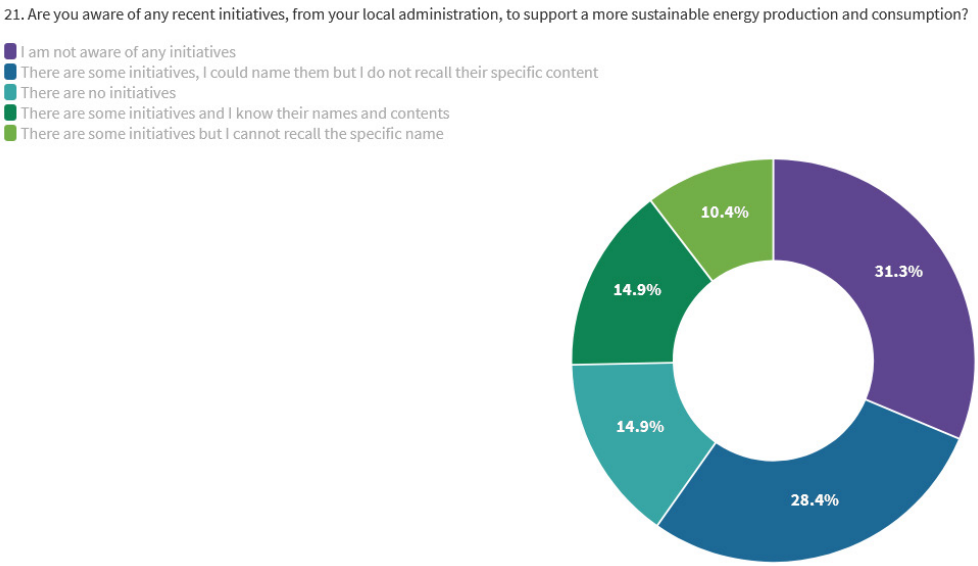


Figure 16. Awareness about the existence of local initiatives supporting renewable energy production – Q21

In the above chart we can see the general awareness regarding the initiatives supporting the energy transition. One the one hand it can be considered a positive trend that almost 54% of respondents knows there are initiatives, no matter if they recall their content and names or not. On the other hand, as much as 31% is not aware of any existing initiatives and 14% of the respondents believes there are no initiatives at all (Figure 16).
Table 8 shows the distribution on the awareness of local initiatives, divided per independent variables. Performing Chi-Squared analysis on the distributions of the response to these questions, showed that there are no differences in the responses neither for Age X^2 (4, N=172) = 8,512, ρ = .075; Geography X^2 (4, N=172) = 6,268, ρ = .180; nor Population Density X^2 (4, N=172) = 4,792, ρ = .309.

	Age		Geography		Population Density	
	Younger	Older	Northern	Southern	Low Density	High Density
There are no initiatives	10%	13%	12%	11%	13%	10%
I am not aware of any initiatives	39%	29%	32%	39%	32%	40%
Total (Unaware)	49%	42%	44%	50%	45%	50%
There are some initiatives, but I can not recall the name	10%	6%	9%	9%	5%	12%
There are some initiatives and I know the names but not the content	16%	35%	30%	16%	24%	19%
There are some initiatives and I know the names and content	25%	17%	17%	26%	27%	19%
Total (Aware)	41%	52%	47%	42%	51%	38%

Table 7. Distribution of respondent on awareness of initiatives

The fact that there are no differences in the distribution among different categories, can be explained by the fact that almost half of the Younger respondents state that there are no initiatives, or are not aware of any initiatives (49%) and 51% of the Younger respondents is aware of the initiatives (name and/or content), and in a similar way 42% of the Older respondents are not aware of initiatives and 58% are aware (name and/or content). The same goes for Geography and Density.
To this concern, **it would be important to reinforce communication strategies targeted for specific initiatives,** since there are no significant general trends, overall, to explain differences in awareness levels. **Each initiative should be promoted at different levels and channels in order to ensure citizens are aware of all available options for the energy transition or, in case they are not in place, support their development.** To go the extra mile, it is worth mentioning how systemic and behavioural change strategies at the individual, collective and societal level have to be activated, in order to engage European Citizens on the long-term and empower them as proactive members of the transition.

Local Communities

When asked about the number one issues and the decisions they would like to be more involved-in when renewable energy production systems are introduced, the majority of respondents (58%) agreed that the most important decision-making process in which local communities should be involved is the assessment of the "environmental impact". All the other decision making processes did not reach the 50% agreement level: "social aspects" (both risks and benefits) was the second most agreed process (47%) followed by "health and safety concerns" (45%). "Siting issues" reached the lower agreement score, yet is worth mentioning that a lower score does not mean at all that they are of no interest at all. (Table 8).

In your opinion, in which decision making processes should local communities be more involved in?	Yes	No
Siting issues (property value, disruption of place).	39%	61%
Environmental impact.	58%	42%
Health and safety concerns.	45%	55%
Societal risks and benefits.	47%	53%

Table 8. Involvement of Local Communities

source: https://www.giuffrefrancislefebvre.it/ || author: Sefa Ozel

No significant differences were found in the Chi-Squared analysis on the levels of different Independent Variables considered, showing that there is a level of agreement that goes beyond differences in Population Density (high vs. low density), Income Range (high vs. low income), Geography Area (northern vs. southern), nor Age (younger vs. older) (Table 9).

Chi-Squared analysis	Population Density		Income Range		Geography		Age	
	X^2	p	X^2	p	X^2	p	X^2	p
Siting issues (property value, disruption of place).	.046	.830	.018	.894	1.414	.234	.001	.971
Environmental impact.	.000	.994	.331	.565	.343	.558	.908	.341
Health and safety concerns.	3.103	.078	.041	.840	.001	.973	.661	.416
Societal risks and benefits.	.004	.949	1.563	.211	1.166	.280	.024	.876

Table 9. Chi-Squared analysis on Ind. Variables levels for involvement of Communities

Public incentives and facilitating measures

Concerning the perceived number of National initiatives that work as incentives for consumers transition to renewable energy sources, 23% of the respondents believes that there are no initiatives or she/he is not aware of them, while an additional 20% knows that initiatives exist, but the content is unknown to her/him. The remaining 57% of the sample, instead is aware and proactive about the incentives for consumer transition (Figure 17). Considering the 57% of the respondents that are aware of National Initiatives, 88% of them believe that the number of incentives or facilitating measures supporting consumers' transitions to renewable energy sources in their country is too little or moderate, while only 12% believe that the incentives are a lot or a great deal (Figure 18).

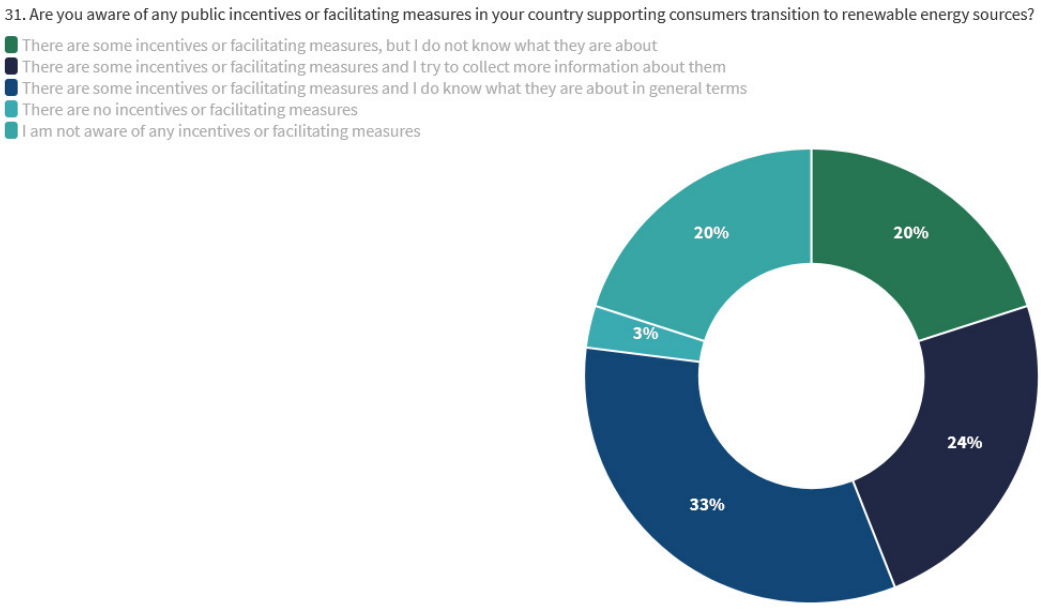


Figure 17. Awareness of National Initiatives for consumers transition to renewable energy sources

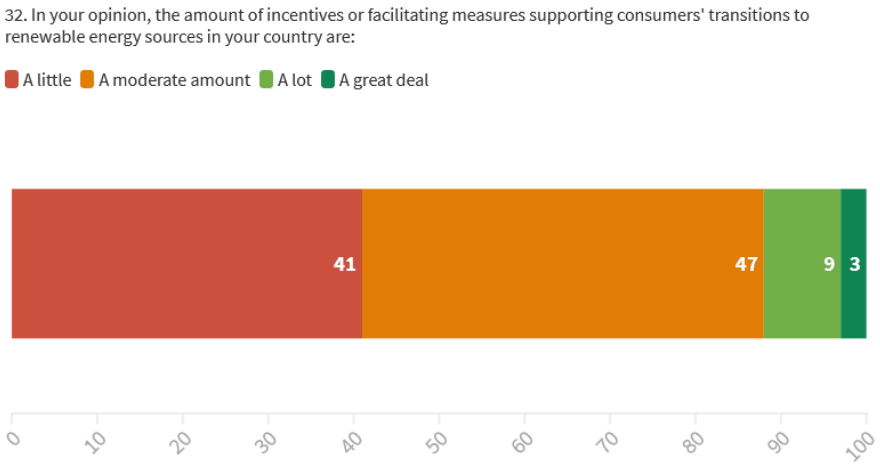


Figure 18. Perceived amount of incentives at National Level

When considering the independent variables impact in an Univariate analysis of the Variance, no significant differences appears on the "national initiatives" (Table 10), neither for Age (younger vs. older), Population Density (high vs. low), Geographical Area (north vs. south) nor Income (high vs. low).

Independent Variable	df	F	Sig.	Partial Eta Squared	Observed Power
Geographical Area	1	2.958	.089	.031	.398
Age Group	1	.740	.392	.008	.136
Population Density	1	.065	.799	.001	.057
Income	1	.292	.590	.003	.083

Table 10. Statistical difference in Variance Distribution for National Initiatives

"Clean Energy for All Europeans" Directive

When asked about their knowledge about the existence of the directive "CLEAN ENERGY FOR ALL EUROPEANS" approved in 2019, 54% of respondents declared to be aware about it, while 46% declared she/he is not aware of it (Figure 19).

NOTE

The Clean Energy for All Europeans[12] obliges Member States to ensure a more competitive, consumer-centered, flexible and non-discriminatory EU electricity market with market-based supply prices. The package consists of eight legislative acts and they must be transposed into national laws of EU countries within 2 years from its approval by the EU parliament.

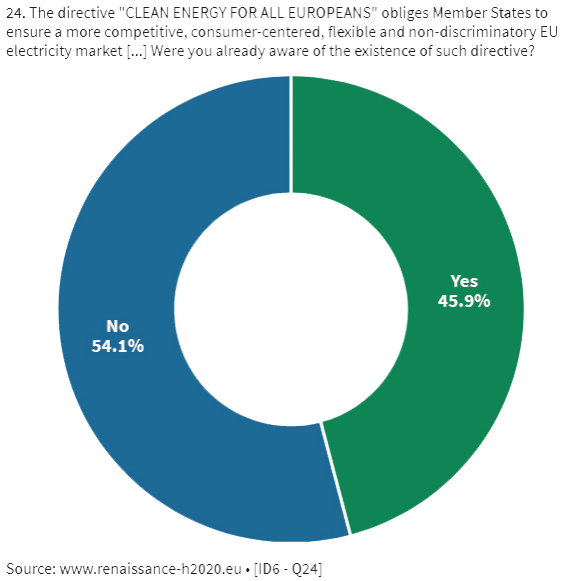


Figure 19. Awareness of the Clean Energy for All Europeans directive – Q24

12 https://ec.europa.eu/energy/topics/energy-strategy/clean-energy-all-europeans_en

Table 11 shows that there are no differences in the awareness of the directive among groups with different Income range, Geography and Population density Areas, but for Age X^2 (1, N=172) = 4,124, p = .042. The awareness of the directive, in fact resulted significantly unequally distribute in the Age groups, with Younger responders NOT being aware of the directive significantly more compared to the Older responders, significantly more aware of the directive. No other independent variables were able to explain the variance of frequency in a significant way.

Chi-Squared analysis	Population Density		Income Range		Geography		Age	
	X^2	p	X^2	p	X^2	p	X^2	p
Awareness of the "Clean Energy for All Europeans" Directive	.156	.693	.069	.792	.519	.471	4.124	042

Table 11. Chi-Squared analysis for Directive Awareness, on Ind. Variables levels

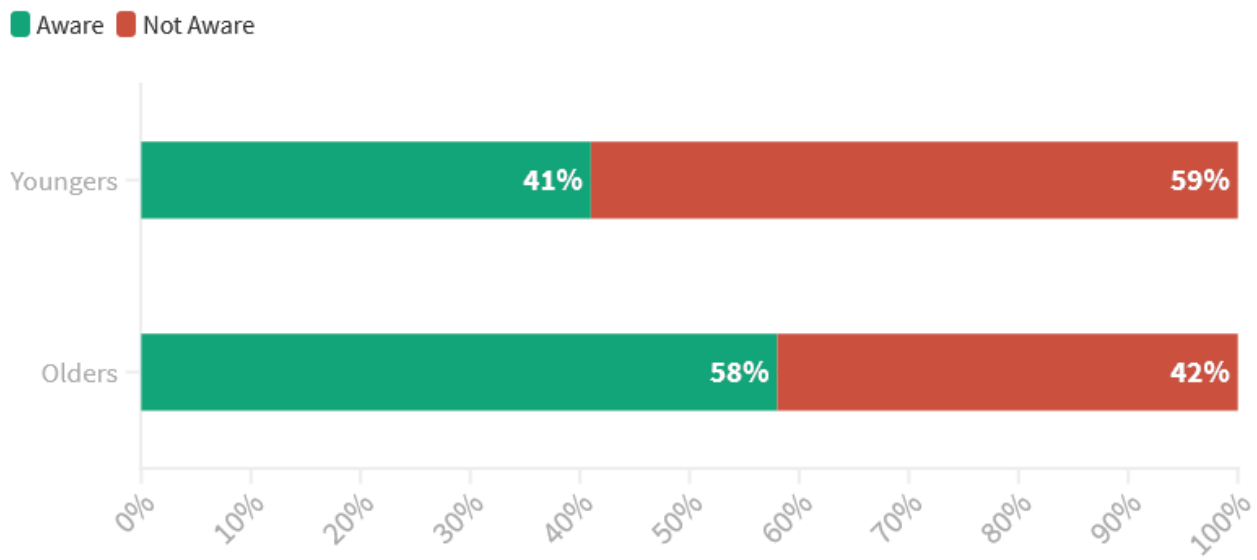


Figure 20. Significant difference in Clean Energy for All Europeanst awareness by Age groups

Regarding the perceived importance of such directive, it must be noted that 75% of the sample considered the Directive as "Very" or "Extremely" important, while only 2% of the sample consider the directive as not "so" or important "at all". Similar distribution can be found among the respondents that were previously aware of the directive, before being introduced to it by the survey, as in the ones that previously were not aware of the directive, before reading its brief description and links at this point of the survey: both groups consider the directive extremely and very important, and that opinion is significantly higher than the ones that do not consider it important, which are the very minority, in both conditions X2 (5, N=172) = 18,175, p = .003. It can, also, be noted that the relative majority of the respondents that considered the Directive very important were the ones that previously were not aware about it. (Figure 21).

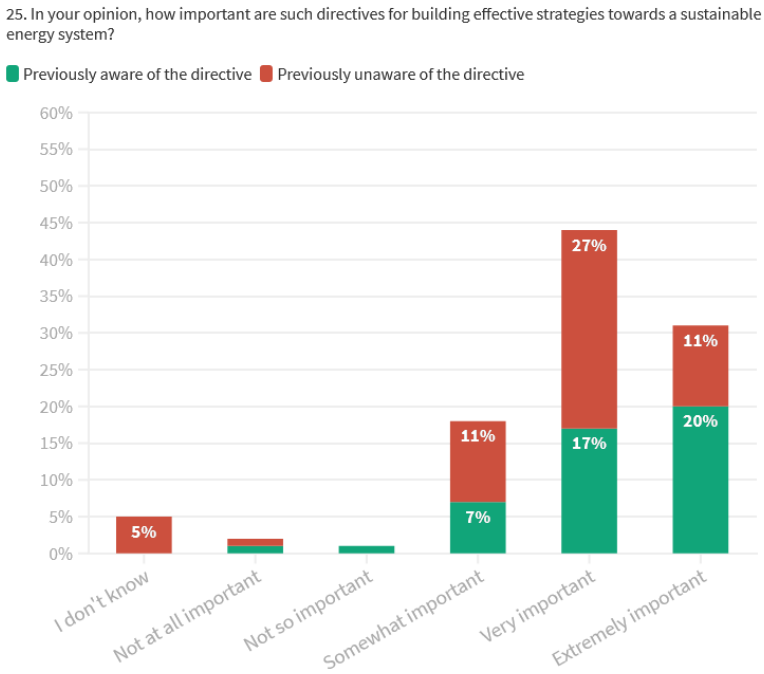


Figure 21. Perceived importance of the Directive

As a conclusion, an evenly distributed weak knowledge regarding measures supporting the transition to a sustainable energy system doesn't derive from a low consideration of the importance of such initiative but most likely from the unclear amount of existing ones or, more significantly, from the lack of appropriate information about them.

Conclusions

1. Almost half of respondents, independently from their age, income or geographic distribution, are not aware of any existing local or regional initiatives and 10% to 13% of the respondents believes there are no initiatives at all. Such data clearly indicates there are gaps in the effective citizens' outreach by such initiatives.
2. Respondents agree on the need for a higher involvement of local communities into decision-making processes when it comes to environmental impact, followed by societal risks and benefits.
3. A vast majority of respondents believe that the amount of incentives or facilitating measures for the consumers' transition to renewable energy sources are moderate to low.
4. All respondents, previously aware of the Directive or not, consider it extremely or very important. Plus, the relative majority of the responders that considered the Directive very important were the ones that previously were not aware about it.

source: https://www.pexels.com// || author: slon_dot_pics

1.5.4. SECTION III – PERCEIVED RISKS

The section III of the survey focuses on the perceived risks preventing respondents to switch to renewable energy technologies.

Economic drivers for changing to a renewable energy only provider only

In general, as expected, the participants would be more likely to switch to a renewable energy provider, if that would involve lower costs (Figure 22).

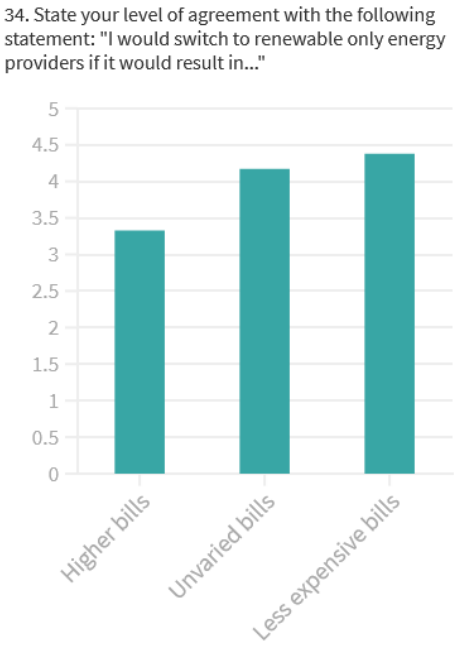


Figure 22 I would switch to renewable-only energy provider if.. – Q34

A Repeated multivariate analysis of variance (MANOVA) for Income, Age Population density and Geographical Area was performed on the driver "cost on the bills" (3-level variable: Less, Unvaried, Higher costs). Table 13 shows that the levels "cost of bills" are indeed impacting significantly the decisions $F(2, 124)$, $F= 10.997$, $p= .001$, $\eta p^2=.092$.

Variables		df	F	Sig.	Partial Eta Squared	Observed Power
Cost of Bills	Assuming Sphericity	2	10.997	.000	.092	.991
	Huynh-Feldt	1.778	10.997	.000	.092	.984
Population Density	Assuming Sphericity	2	.791	.455	.007	.184
Income	Assuming Sphericity	2	1.303	.274	.012	.280
Geography	Huynh-Feldt	1.778	4.538	.015	.040	.732
Age	Assuming Sphericity	2	1.074	.344	.010	.237

Table 12. Multivariate Analysis for cost on the bill factor

Looking closely at age ranges, people belonging to the <45Y group tend to be more likely to pay an extra cost to obtain sustainable energy compared to the respondents belonging to the >45Y group (Figure 23), but the difference was not significant.
However, **a significant difference can be found when considering the Geographical Area of the respondents:** while both Northern and Southern Europe respondents agree that "Less Expensive" bills are the first driver, a significant difference appears for the "Unvaried costs", with Southern respondents more willing to accept no variances in price for renewable only supplier, while Northern respondents less keen to accept unchanged or higher bills (Figure 24).

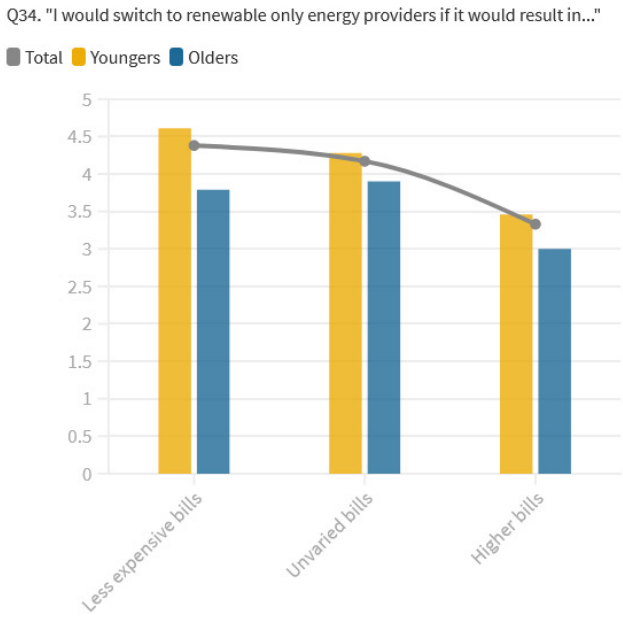


Figure 23. Driver of cost of the bills before switching to a renewable only energy provider by Age Group – Q34

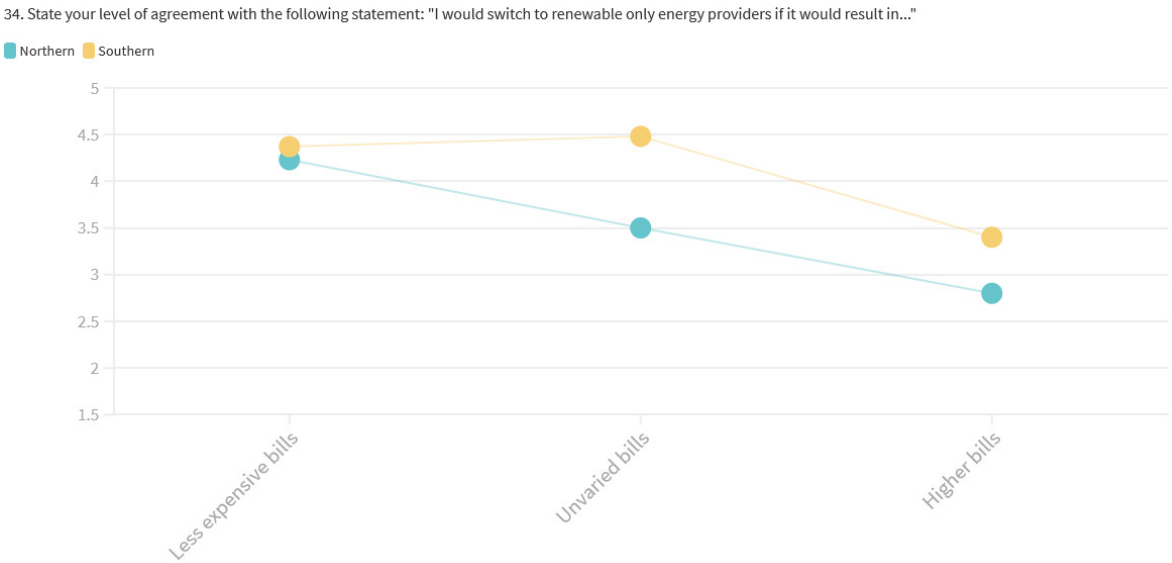


Figure 24. Driver of cost of the bills before switching to a renewable only energy provider by Geographical Area

Switching to a renewable energy only provider

In terms of ranking of "Risks preventing acceptance to switch to a renewable energy only provider", on average, respondents ranked as the first blockers the hidden or unknown costs (Mode = 1st); followed by transparency issues (Mode = 2nd) and fear of lower maturity of services (Mode = 2nd).
Considering the ranking as a continuous scale (four-point Likert scale on agreement of the main risk) a repeated multivariate analysis of variance (MANOVA) for income, age population density and geographical area was performed on the switch-risks identified (4-level variable: low maturity of service; hidden or unknown costs; too much hassle to switch; transparency issues). Table 13 shows that the levels "cost of bills" are indeed impacting significantly the decisions $F(2, 124)$, $F = 6.708$, $p = .001$, $\eta p^2 = .057$. More precisely Geography Area is, once again, a significant factor, with Southern respondents overall fearing most the cost, and Northern respondents fearing significantly lower quality services (Figure 25).

Variables		df	F	Sig.	Partial Eta Squared	Observed Power
Cost of Bills	Assuming Sphericity	3	6.708	.000	.057	.974
	Huynh-Feldt	2.888	6.708	.000	.057	.971
Population Density	Assuming Sphericity	3	.401	.752	.004	.129
Income	Assuming Sphericity	3	2.151	.094	.019	.546
Geography	Huynh-Feldt	2.888	3.095	.029	.027	.708
Age	Assuming Sphericity	3	.355	.785	.003	.120

Table 13. Multivariate Analysis for switch risks factor

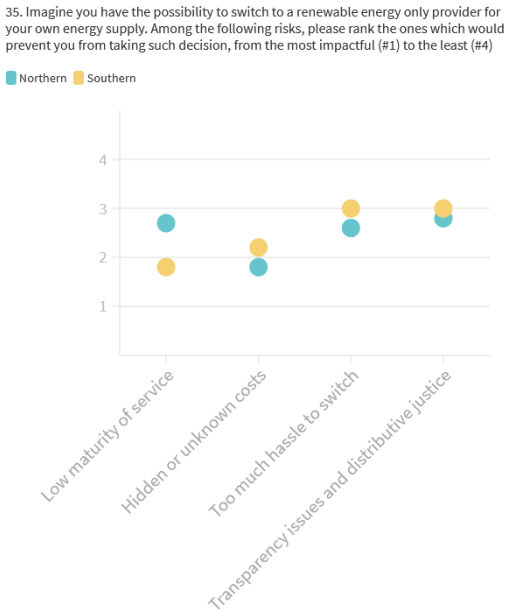


Figure 25. Ranking of the top risks before switching to a renewable-only energy provider by Geographical Area – Q35

Install small or medium sized renewable production systems in own property

The metrics show a detailed description of the most **impactful risks tied to the possibility to install a small to medium sized renewable energy production system in own property** (e.g. photovoltaic panel). Figure 26 shows the ranking of the main perceived impact, with high maintenance costs as first, followed by environmental and safety concerns.

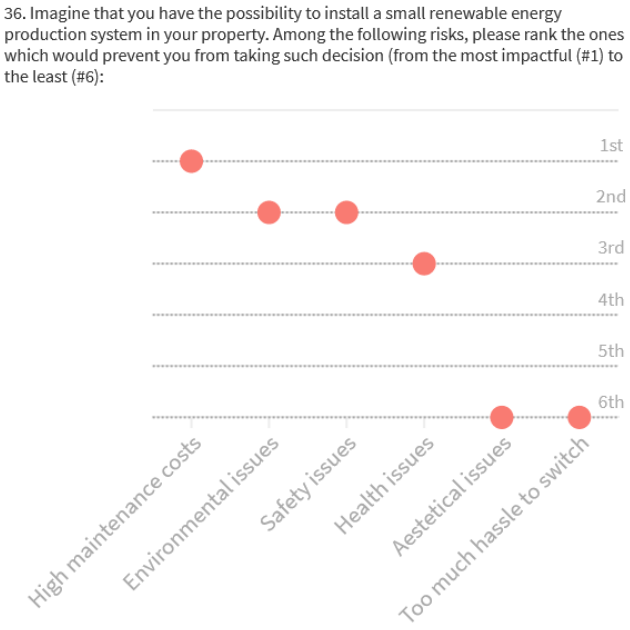


Figure 26. Ranking of the top risks preventing installation of a small renewable energy production system in own property (Mode) – Q36

Considering the ranking as a continuous scale (six-point Likert scale on agreement of the main impact), a repeated multivariate analysis of variance (MANOVA) for Income, Age Population density and geographical area was performed on the Impact of the risks identified (6-level variable: Safety; high maintenance costs; aesthetical; environmental; health; hassle). Table 14 shows the different risk factors are indeed impacting in a different way on the the decisions $F(5, 124)$, $F= 4.451$, $\rho= .001$, $\eta\rho^2=.039$. No additional significant differences were found when considering Age, Geographical Area, Population density nor Income (Figure 27).

Variables		df	F	Sig.	Partial Eta Squared	Observed Power
Impact	Assuming Sphericity	5	4.451	.001	.039	.970
	Huynh-Feldt	5.000	4.451	.001	.039	.970
Population Density	Assuming Sphericity	5	.453	.811	.004	.172
Income	Assuming Sphericity	5	1.001	.417	.009	.359
Geography	Huynh-Feldt	5.000	1.870	.098	.017	.638
Age	Assuming Sphericity	5	.408	.844	.004	.158

Table 14. Multivariate Analysis for Impact of the risks factors on istallation

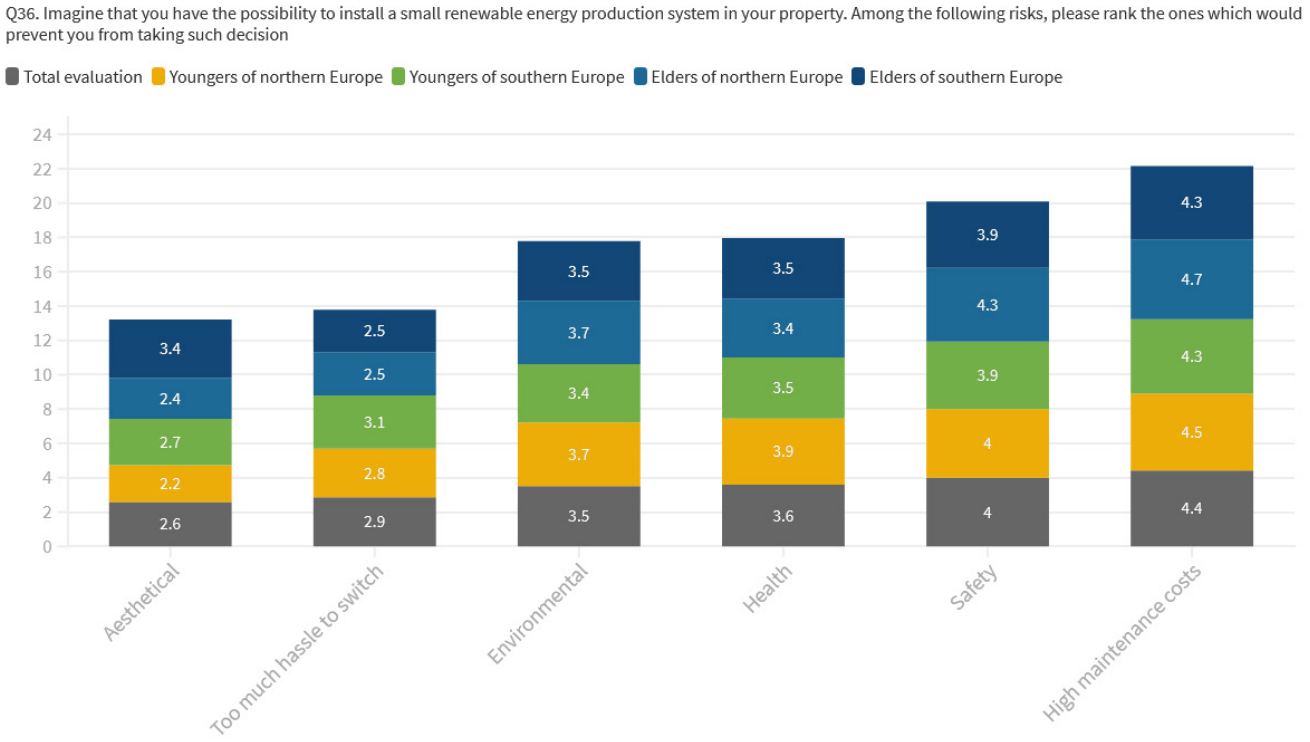


Figure 27. Ranking of the top risks preventing installation of a small renewable energy production system in own property by Age and Geographical Area

In general, looking at the non statistically-significant tendencies, the high maintenance costs tend to be the most impactful risks taken in consideration by Northern and Southern European citizens, followed by safety and health concerns equally distributed between the two geographic groups. In fourth position there are the environmental concerns, on which the Northern countries show higher sensitivity. The difficulties to switch to a renewable energy system tend to be more concerning for the youngers of the Southern Europe, while the aesthetical issues are taken in higher consideration from the elders of Northern Europe, almost as much as the environmental issues.

Accept a local medium renewable production plant for collective consumption

When asked to imagine that a renewable energy production plant was going to be built in the local village/neighbourhood for collective consumption of local community (Figure 28) the main risks ranked as the ones that would prevent them from accepting such decision were hidden or unknown costs and health (e.g. glare effect, noise and infrasound, electromagnetism) impact, followed by safety concerns (e.g. potential adverse events related to malfunctions and/or damaged systems).

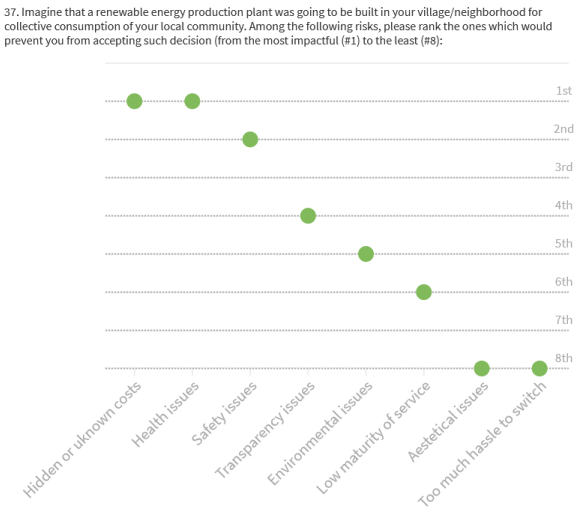


Figure 28. Risks preventing the acceptance of a small to medium renewable energy production plant in own village/ neighbourhood for collective consumption (Mode) – Q37

Considering the ranking as a continuous scale (eight-point Likert scale on agreement of the main impact), a repeated multivariate analysis of variance (MANOVA) for Income, Age Population density and Geographical Area was performed on the impact of the risks identified (8-level variable: health; hidden costs; environmental; transparency; low maturity; hassle; aestetical). Table 15 shows the different perceived impact factors have a small but significant effect on the respondents F(7, 124), F= 2.035, ρ= .048, $\eta\rho^2$=.018. No additional significant differences were found when considering Age, Geographical Area, Population density nor Income.

Variables		df	F	Sig.	Partial Eta Squared	Observed Power
Impact	Assuming Sphericity	7	2.035	.048	.018	.792
Population Density	Assuming Sphericity	7	1.360	.219	.012	.584
Income	Assuming Sphericity	7	1.767	.091	.016	.721
Geography	Huynh-Feldt	6.531	1.419	.199	.013	.583
Age	Assuming Sphericity	7	.525	.816	.005	.1230

Table 15. Multivariate Analysis for Perceived Impact of Energy Production Plant Nearby

Looking at the perceived risks deriving from the construction of a **local renewable energy production plant,** we find a tendency for a discrepancy between the citizens of Northern and Southern Europe. In fact, the firsts declare to be more concerned for the hidden or unknown costs for the community, while in Southern Europe the concern is stronger for the safety issues (malfunctioning or damaged plants). The third position is occupied by the health concerns, deemed slightly more important than the maturity of the service/market (Figure 29).

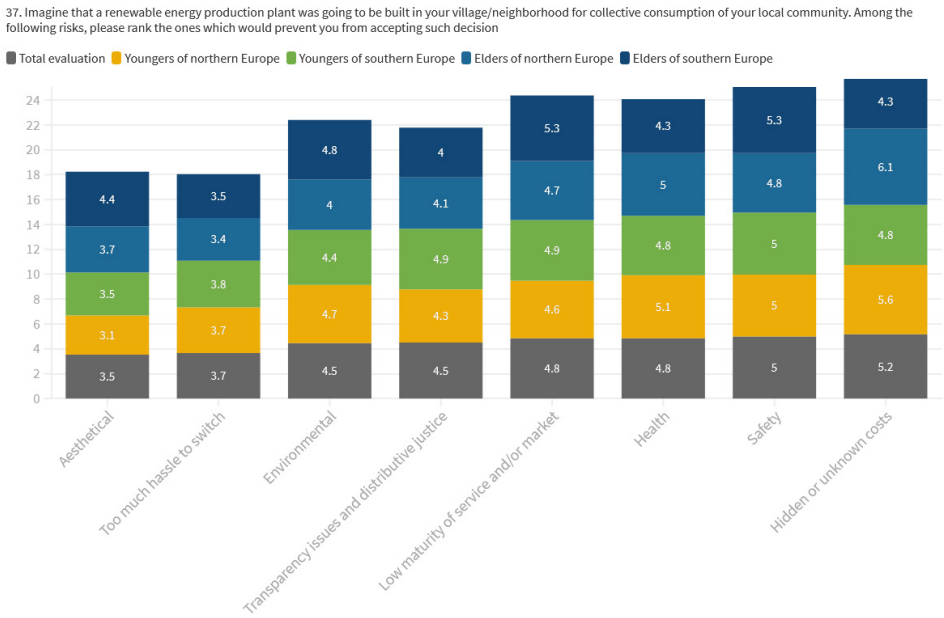


Figure 29. Risks preventing the acceptance of a small to medium renewable energy production plant in own village/ neighbourhood for collective consumption by Age and Geographical area

Conclusions

1. Cheaper energy bills are of course a main diver for change, though Southern Europe respondents are more willing to accept unvaried energy bill for renewable only supplier compared to Northern Europe respondents, who would rather accept lower prices.
2. The main risks preventing respondents to switch to a renewable energy only provider are the hidden costs, followed by transparency issues and low maturity of service.
3. The main fear related with the possibility to install a small to medium sized renewable energy production system in own property is the high maintenance cost, followed by the fear of the environmental impact and safety issues. This suggests a higher penetration of such solutions could be obtained if they came together with maintenance and disposal services.
4. Respondents would accept a local renewable energy production plant only if they were guaranteed a high degree of transparency in terms of costs, health and safety impacts.

source: https://www.pexels.com// || author: Maria Orlova

1.5.5. SECTION IV – PERCEIVED BENEFITS

Benefits of switching to a renewable only energy provider

Concerning the benefits that would come from **adopting renewable technologies** (Figure 30), **the one identified as most relevant are the environmental benefits** (e.g. lower emissions) **and the economical benefits.** On the other hand, community engagement (i.e. higher involvement in choices, higher control over energy production) and the community awareness (e.g. higher chances to learn about renewable energy) are the latest important benefits, as perceived by the respondents.

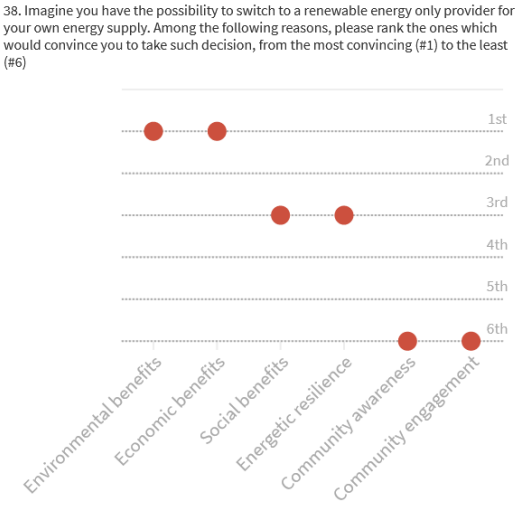


Figure 30. Ranking of benefits of switching to a renewable energy only provider for own energy supply (Mode)- Q38

Considering the ranking as a continuous scale (six-point Likert scale on agreement of the main benefits), a repeated multivariate analysis of variance (MANOVA) for income, age population density and geographical area was performed on the perceived benefits identified (6-level variable: environmental; economic; social; resilience; community awareness and engagement). Table 16 shows the different risk factors are indeed impacting in a different way on the decisions F(5, 124), F= 7.227, ρ= .001, $\eta\rho^2$=.064, but no additional significant differences were found when considering Age, Geographical Area, Population density nor Income, meaning that there are no significant differences across age ranges, living contexts or geographic areas on the perceived benefits of adopting renewable technologies.

Variables		df	F	Sig.	Partial Eta Squared	Observed Power
Benefits of Technology	Assuming Sphericity	5	7.227	.000	.064	.999
	Huynh-Feldt	5.000	7.227	.000	.064	.999
Population Density	Assuming Sphericity	5	1.024	.403	.010	.367
Income	Assuming Sphericity	5	.591	.707	.006	.217
Geography	Huynh-Feldt	5.000	.668	.648	.006	.243
Age	Assuming Sphericity	5	.829	.529	.008	.299

Table 16. Multivariate Analysis for Perceived Benefits of renewable technologies

Benefits of Becoming a Prosumer

Concerning the benefits that would come from being a prosumer by installing an individual renewable production system in their own property (Figure 31), the one identified as most relevant are, similarly as for the benefits for switching to different providers, are the environmental benefits (e.g. lower emissions) and the economical benefits (e.g. lower energy costs, potential income). On the other hand, Community awareness (e.g. higher chances to learn about renewable energy) and the community engagement (i.e. higher involvement in choices, higher control over energy production) are the latest important benefits, as perceived by the respondents.

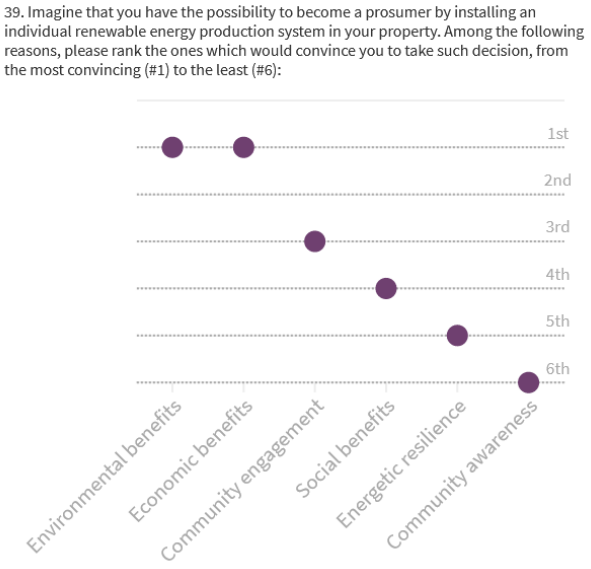


Figure 31. Ranking of benefits installing an individual renewable production system in own property and become a prosumer (Mode) – Q39

Once again, running a eepeated multivariate analysis of variance (MANOVA) for income, age population density and geographical area was performed on the perceived benefits of installing small renewable energy systems (6-level variable: environmental; economic; social; resilience; community awareness and engagement), and significant difference emerged in the perception of the different type of benefits F(5, 124), F= 9.282, ρ= .001, $\eta\rho^2$=.081. No Table 14significant differences were found when considering Age, Geographical Area, Population density nor Income (Table 18).

Variables		df	F	Sig.	Partial Eta Squared	Observed Power
System Benefits	Assuming Sphericity	5	9.282	.000	.081	1.000
	Huynh-Feldt	5.000	9.282	.000	.081	1.000
Population Density	Assuming Sphericity	5	1.162	.327	.011	.415
Income	Assuming Sphericity	5	.184	.969	.002	.094
Geography	Huynh-Feldt	5.000	.158	.978	.002	.087
Age	Assuming Sphericity	5	1.244	.287	.012	.444

Table 17. Multivariate Analysis for Perceived Benefits of becoming a Prosumer

Benefits of buying energy from a local renewable energy production plant

For the majority of respondents, the appeal of buying or consuming locally produced renewable energy, find once again the environmental benefits (e.g. lower emissions) and the economical benefits (e.g. lower energy costs, potential income) as the main benefits. This time, it must be noted that the community engagement (i.e. higher involvement in choices, higher control over energy production) is the ranked as the second most important one, while the community awareness (e.g. higher chances to learn about renewable energy) remains the latest important benefits perceived by the respondents (Figure 32).

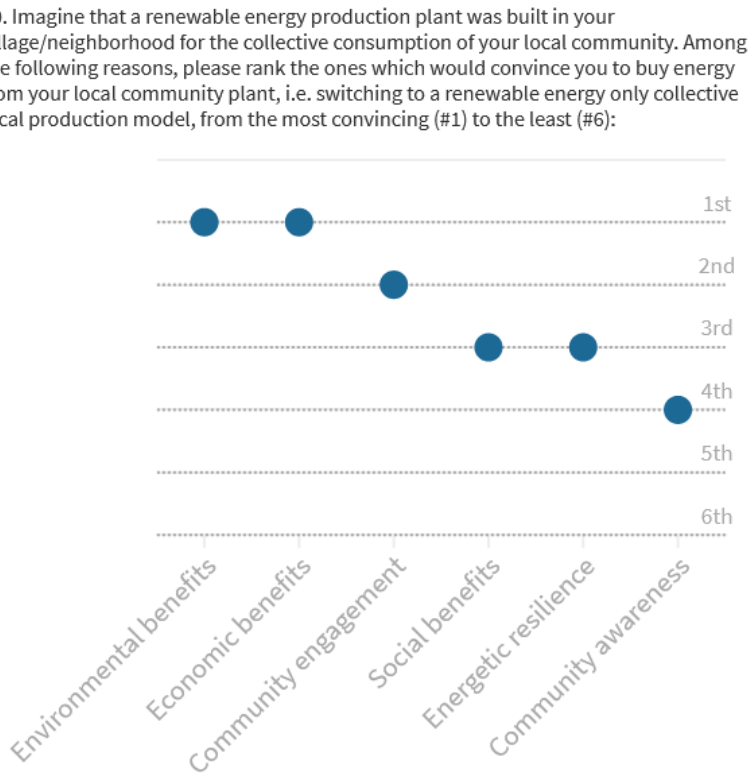
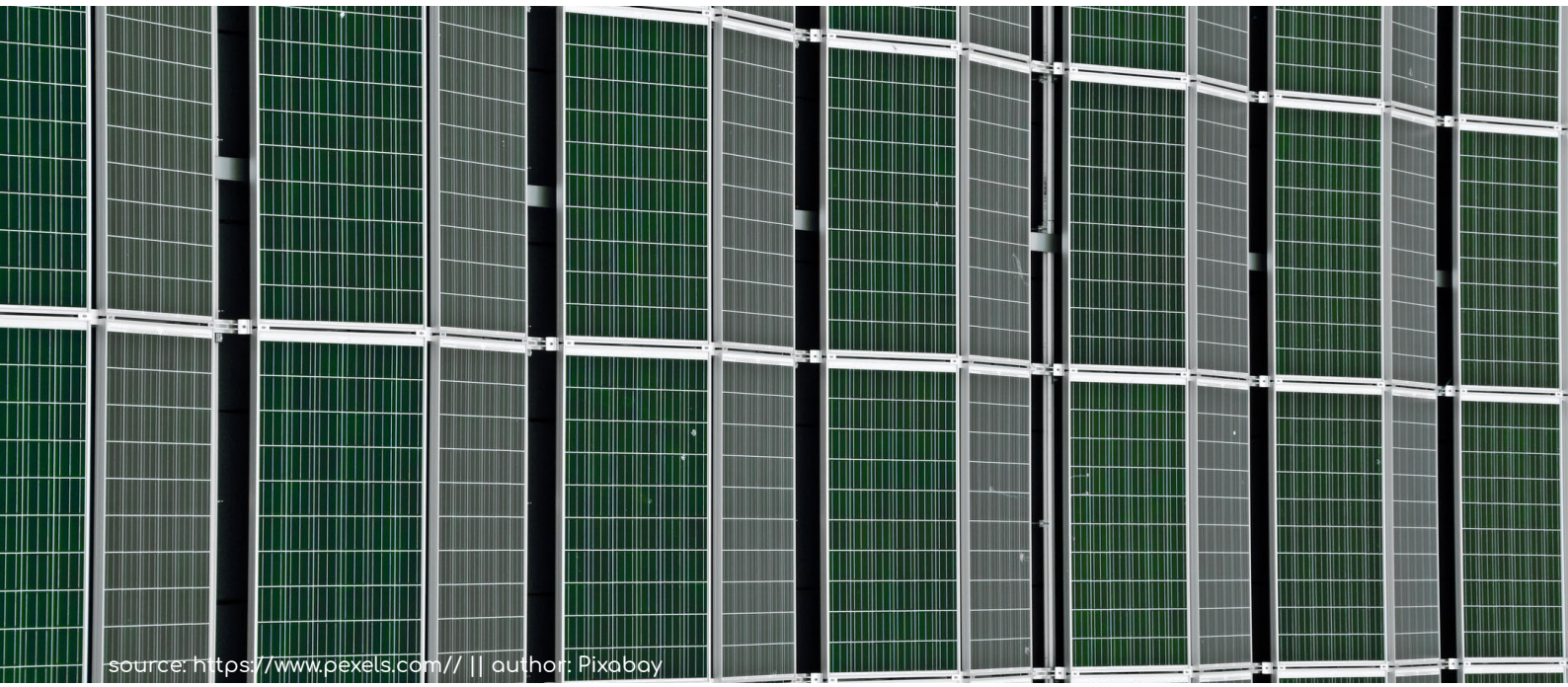


Figure 32. Perceived Benefits of consuming energy produced in local renewable energy production plants (Mode) – Q40

Conclusions

1. Indipendently from the typology of energy production system adopted, the main drivers towards the transition to renewables are the lowest co2 emissions, followed by social and economic benefits for the community.
2. Energy resilience is, in all cases, stronger than the community involvement and raised awareness concerning the available energy system innovations.
3. In the hypothesis of consuming or buying locally produced energy the community engagement factor becomes stronger than the social benefits, which can be read as a higher need for involvement
4. The homogeneity in answers given by respondents of different areas, age and income should be considered when framing campaigns targeting energy consumers, focusing on the collective environmental and socio-economical benefits for the common good.



source: https://www.pexels.com// || author: Pixabay

1.5.6. SECTION V – BUSINESS MODELS

Type of Business model

With no further introduction, the participants were asked to evaluate the ideal model for the energy market, choosing among four different options as described in the (Table 18).

Since one of the survey objectives was that of exploring the level of acceptance of RENAISSANCE solutions and understand how beneficial they are perceived for the community as a whole, it was considered important to collect answers about Business Models before asking about general acceptance levels towards renewable energy solutions. This way, the declared acceptance of business models of Section V would not be influenced by the more individualistic perspective of Section VII.

Proposed energy system scenarios take up those scenarios identified as most feasible by pilot site stakeholders through the MAMCA methodology. The business models that were analysed within the questionnaire resulted from a) a thorough literature study on business models for energy communities (T3.1) and b) a discussion on feasible scenarios at the pilot sites (D2.1). The analysed models are simplified classifications using key characteristics in terms of location of assets, size, investment, energy trading model and decision-making process.

Model	Location of Assets	Size	Investment	Energy Trading Model	Decision-Making Process
Prosumer	Consumers are incentivized to install production systems on their own property to become prosumers.	Small sized system (e.g., solar panels on rooftops, small scale wind or geothermal systems).	Prosumers invest in their own energy production system for own consumption.	Energy is produced with the aim of collecting revenues; surplus energy is directly fed into the grid and remunerated by the central grid system operator for a set tariff.	The involvement in decision making is low. Beyond from the initial choices about investment and amount of energy trades, there is no power of decision on any other matter related to the energy production, consumption trading. The amout of revenues collected by the prosumer depends on the amount of energy power installed.
Organized, P2P, Virtual Power Plant	Prosumers are incentivized to install production systems in their own property.	Small sized system (e.g. solar panels on rooftops, small scale wind or geothermal systems).	Prosumers invest in their own energy production system for own consumption.	Energy is produced mainly to cover own consumption needs. Surplus energy is traded directly to other consumers (e.g., the neighbours) or aggregated and sold to the wholesale energy market.	The involvement in decision making is limited. Since energy peers or groups of prosumers have an active role in the energy market, a certain power on tariff setting may emerge when selling energy to aggregators or wholesale market.

Model	Location of Assets	Size	Investment	Energy Trading Model	Decision-Making Process
ESCO	The energy supply company owns the energy plants that are dislocated locally.	Medium to large scale renewable energy plant.	Large investments from energy supply company owners are required. End-users are contributing to the return of investment simply buying energy from the company.	Energy is produced with the aim of collecting revenues. Energy produced by the energy supply company is sold to the wholesale market. End-users pay their bill according to their current energy contract.	There is no involvement in decision making. Choices are taken by the management of involved actors and decisions follow the top-down flow.
Energy Community	Local renewable energy plants are installed in community member own property and/ or dislocated in local available areas through a community decision process.	Small sized system (e.g. solar panels on rooftops, small scale wind or geothermal systems).	Requires a shared investment from all members of the community. The amount of local energy production covers the overall community consumption.	Energy is produced to cover community consumption needs. Surplus energy is aggregated and sold to the wholesale market, directly to other consumers or stored for future demand. Revenues are distributed among community members in a form of retribution or new investments.	The involvement in decision making is high. All members of the community have the right to vote on issues concerning the use of collected revenues, new investments and market strategy.

Table 18. Preference Scores for each Business Model

Table 20 sums up the score of the overall sample of respondents. As it can be seen, the most favourite Business Model is the Energy Community model (M=4.17, SD=1), while the least preferred one is the ESCO model (M=2.7, SD=1.2).

				Cumulate Percentage		
	M	SD	Sum	25%	50%	75%
ENERGY COMMUNITY	4.17	1.052	647	4.00	5.00	5.00
P2P	3.73	1.071	578	3.00	4.00	5.00
PROSUMER MODEL	3.37	1.185	523	2.00	3.00	4.00
ESCO	2.73	1.286	423	2.00	3.00	4.00

Table 19. Preference Scores for each Business Model

Performing the Repeated Multivariate Analysis of Variance (MANOVA) it was possible to look for statistical difference for Income, Age Population density and Geographical Area on the preferences expressed for the type of Business Models (4-level variable: Prosumer, P2P, ESCO, Energy Community). Table 21 shows that there are very significant differences among the ratings of the four different systems F(4, 139), F= 16.931, ρ= .001, $\eta\rho^2$=.114, but no additional significant differences were found when considering Age, Geographical Area, Population density nor Income, meaning that **there is no effect of age, income, living contexts or geographic areas on the way to choose the favourite business model** (Figure 33).

Variables		df	F	Sig.	Partial Eta Squared	Observed Power
Business Models	Assuming Sphericity	3	16.931	.000	.114	1.000
	Huynh-Feldt	2.943	11.698	.000	.114	1.000
Population Density	Assuming Sphericity	3	.235	.872	.002	.094
Income	Assuming Sphericity	3	1.229	.299	.009	.346
Geography	Huynh-Feldt	2.943	1.730	.160	.014	.451
Age	Assuming Sphericity	3	.954	.415	.008	.261

Table 21. Multivariate Analysis for Business Models

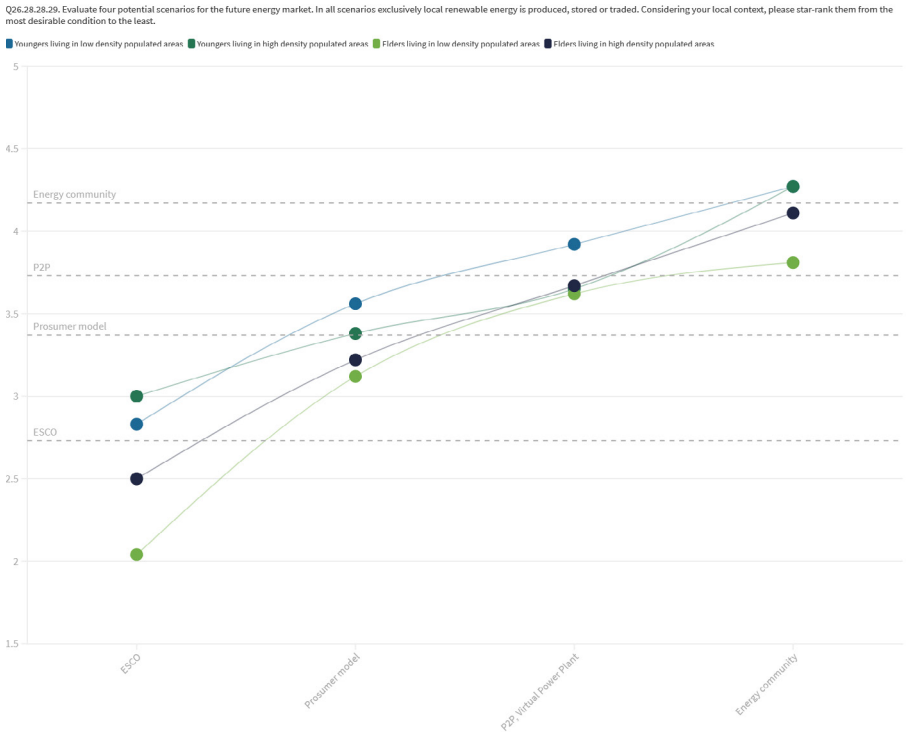


Figure 33. Preferred business models | trends for Age and Density – Q26,27,28,29

Conclusions

1. The current business model, the ESCO model, tend to be the least desirable.
2. The most favourite model is the Energy Community, regardless the age and the population density area of respondents.
3. The Younger group tend to show the strongest preference for the Energy Community business model while the Older group has the weakest preference for the ESCO.

source: https://www.pexels.com// || author: Pixabay

1.5.7. SECTION VI – SOCIAL CONTEXT

Likelihood to ask for advice

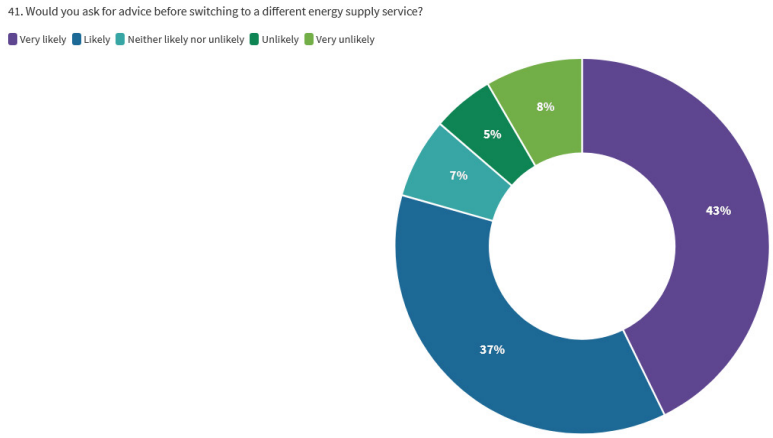


Figure 34. Likelihood to ask for advice before switching to a renewable only energy provider – Q41

The chart shows that around 80% of the respondents are likely or very likely to ask for advice before switching to a renewable energy provider. Table 22 shows that those more likely to ask for advice are respondents living in Southern Europe and highly populated areas, with a high Income. Looking at the 20% that would not ask for advice, it is mainly composed by Older respondents, living in Northern Countries (Figure 34).

	Age		Population Density		Income Range		Geography	
	Youngers	Older	Low Density	High Density	Lower Income	Higher Income	Northern	Southern
Very Unlikely	8.5%	8.1%	8.1%	8.7%	8.8%	5.6%	13.5%	5.1%
Unlikely	4.3%	8.1%	4.8%	5.8%	5.9%	0.0%	5.8%	5.1%
Total (Unlikelihood)	12.8%	16.2%	12.9%	14.5%	14.7%	5.6%	19.3%	10.2%
Neither Unlikely or Likely	7.4%	5.4%	9.7%	4.3%	6.9%	0.0%	5.8%	7.6%
Likely	36.2%	37.8%	27.4%	44.9%	34.3%	55.6%	38.5%	35.4%
Very Likely	43.6%	40.5%	50.0%	36.2%	44.1%	38.9%	36.5%	46.8%
Total (Likelihood)	79.8%	78.3%	77.4%	80.7%	78.4%	94.5%	75.0%	82.2%

Table 21. Distribution of responders' willingness to ask for advice

Source of Advice

Considering the 80% that are likely and very likely to ask for advice and information, the preferred source considered is mainly **friends and colleagues,** evenly followed by publications of experts, internet and social media Figure 35.

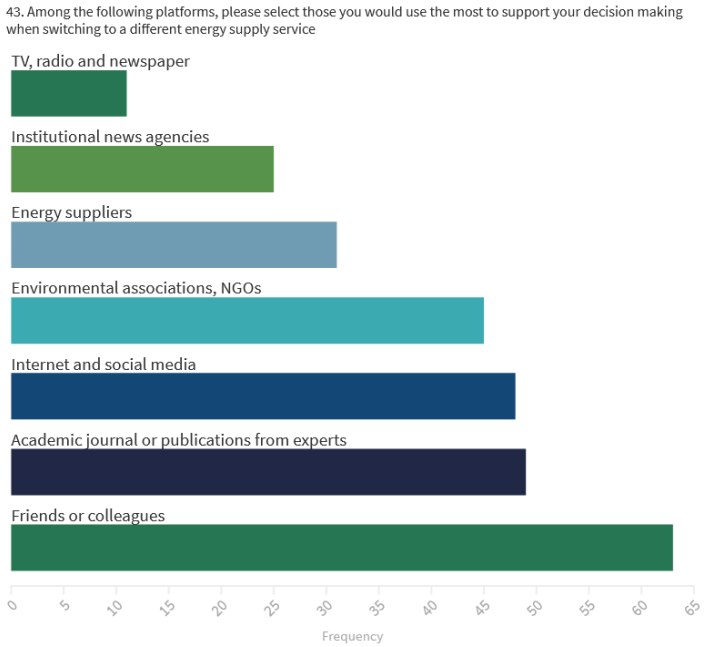


Figure 35. Preferred Source of Advice – Q43

source: https://www.brandwatch.com/

Table 22 shows the distribution of the preferred sources of advice, per Age, Geographical Area, Population Density and Income.
Depending on the different activity it could be possible, therefore to promote information using the channels that citizens use more as a source of advice, in order to provide timely and adequate information. It is an important challenge that of ensuring citizens have access to clear, transparent and consistent information.

Source (Multiple Choices)	Age		Population Density		Income Range		Geography	
	Youngers	Older	Low Density	High Density	Lower Income	Higher Income	Northern	Southern
TV, Radio and Newspapers	4.6%	9.8%	5.1%	7.1%	5.0%	14.3%	5.3%	6.8%
Energy Suppliers	20.5%	19.7%	22.2%	18.6%	20.0%	21.4%	21.3%	19.5%
Environmental NGO	25.8%	29.5%	22.2%	31.0%	28.1%	28.6%	23.4%	29.7%
Internet and Social Media	30.5%	24.6%	32.3%	25.7%	31.3%	17.9%	23.4%	33.1%
Academic Journals	29.8%	26.2%	37.4%	21.2%	28.8%	32.1%	20.2%	35.6%
Friends and Colleagues	33.8%	34.4%	31.3%	36.3%	34.4%	35.7%	26.6%	39.8%

Table 22. Distribution of the Sources of Advice

Conclusions

1. Respondents living in southern Europe and highly populated areas, with a high Income declare a stronger need to ask for advice before switching to renewable, compared to older respondents from northern countries.
2. Friends and colleagues are considered by far the most reliable source for advice, with expert publication and academic journals as second. Internet and social media follow, almost au pair with environmental associations and NGOs.
3. Analysing the different sources for advice, it becomes clear how information channels on which respondents rely on change dynamically across age ranges, income and geographic areas. More in-depth research could offer interesting perspectives in this sense.
4. The more precise and clear the information provided, the higher the chances that citizens find the support they need to make responsible choices and access the solutions most appropriate to the specific context.

source: https://www.pexels.com// || author: Pixabay

1.5.8. SECTION VII – ACCEPTANCE

Acceptance to install in own property

Accepting to install a small/medium sized renewable energy production system in own property is not an easy decision to make. A vast majority of respondents agree that producing energy **for own consumption** is the preferred option (60%), followed by the possibility of sharing part of the energy produced with the local community (43%) (Figure 36).

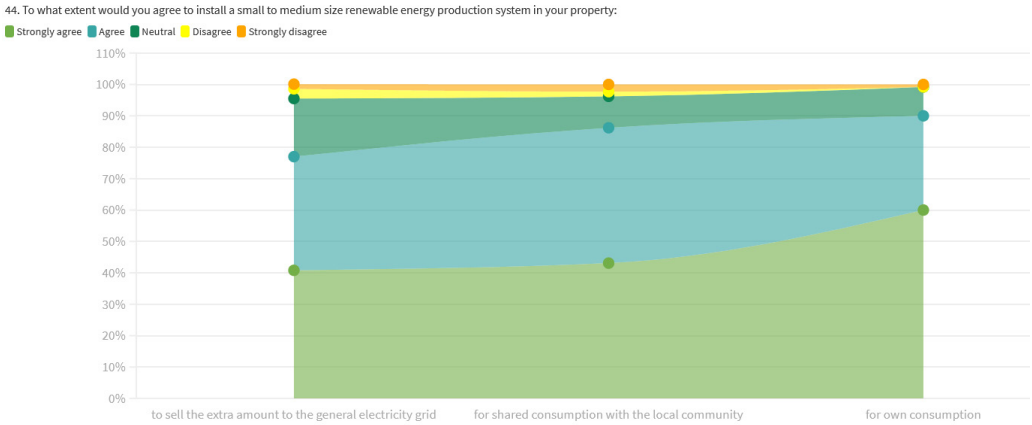


Figure 36. Acceptance Criteria for installing in own property – Q44

The distribution of answers for the different background info of the sample for "Own Consumption", organised in Negative vs. Positive attitudes, is shown in Table 23.

	Gender		Age		Geography Area		Population Density		Income	
	Male	Female	Younger	Older	Northern	Southern	Low Density	High Density	Lower Income	Higher Income
Negative	2%	0%	0%	3%	0%	1%	0%	1%	0%	6%
Neutral	14%	6%	10%	8%	13%	6%	6%	12%	8%	17%
Positive	84%	94%	90%	89%	87%	92%	94%	87%	92%	78%

Table 23. Acceptance criteria difference for Own Consumption

In the hypothesis of a local renewable energy production plant, being directly involved into the energy market to obtain economic revenues i.e. bill discounts is considered as acceptable as the sharing for the collective consumption of the local community (Figure 37). Meaning that the participation in the energy transition is driven more by energy saving and collective benefits rather than seen as an investment.

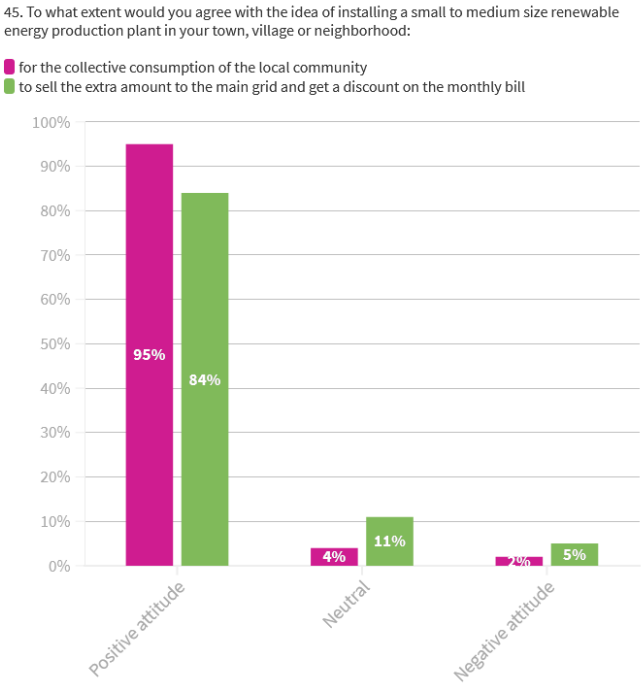


Figure 37. Level of agreement about share for collective consumption or selling the extra amount of energy produced in a local energy production plant – Q45

Favourite system

In line with the previous consideration, systems option for a renewable energy supply that was rated more frequently as acceptable one, is the **small renewable energy production system in your property to sell the extra amount to the network** (54%). The second option to reach more agreement was the **Small/Medium size renewable energy production plant built in your town to SELL energy to the general electricity grid and get a discount on your monthly bill** (46%). The last two options focused on shared consumption appeared to be less appealing, with the option" **Small/Medium size renewable energy production plant built in your town for SHARED collective consumption** attracting the most negative attitude (58%) (Figure 38).

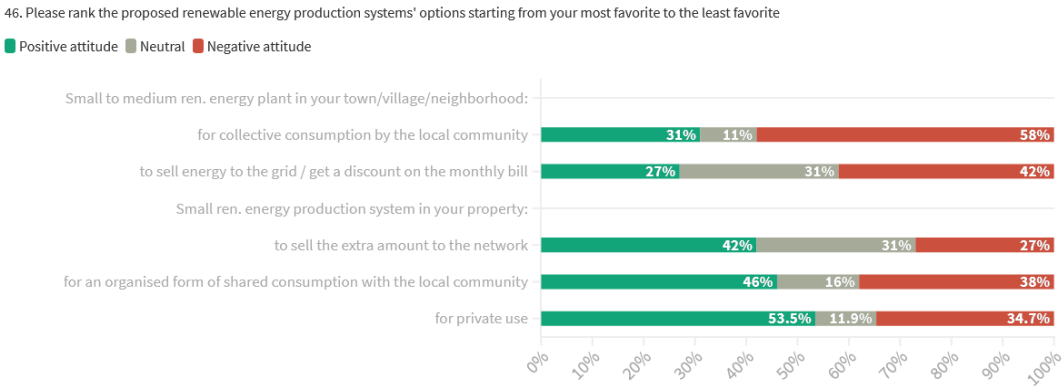


Figure 38. Respondent's favourite systems option for a renewable energy supply – Q46

A repeated multivariate analysis of variance (MANOVA) for Income, Age Population density and Geographical Area was performed on the different type of systems (5-level variable). Table 24 shows that there are significant but small differences among the different systems F(4, 124), F= 2.720, ρ= .030, ηp^2=.029, but -once again- no additional significant differences were found when considering Age, Geographical Area, Population density nor Income, meaning that **there is no effect of age, income, living contexts or geographic areas on the way to choose the favourite system.**
A deeper analysis of the preferences expressed by people living in different population density areas, shows a non-significant trend, for those living in rural contexts, which prefer small renewable energy systems in their own property. On the other hand the people living in densely populated area tend to prefer local energy production plant rather than individual ones, most likely depending on the scarcity of appropriate spaces in the built environment or stricter bureaucracy and authorization procedures. But those are currently non-significant trend that will be further investigated in the following phases of the project.

Variables		df	F	Sig.	Partial Eta Squared	Observed Power
Prosumer Benefits	Assuming Sphericity	4	2.720	.030	.029	.751
	Huynh-Feldt	3.804	2.720	.032	.029	.734
Population Density	Assuming Sphericity	4	.569	.643	.007	.306
Income	Assuming Sphericity	4	.106	.290	.013	.391
Geography	Huynh-Feldt	3.804	.347	.259	.014	.404
Age	Assuming Sphericity	4	.353	.880	.004	.142

Table 24. Multivariate Analysis for Different Systems

Conclusions

1. Indeed the economical benefits are a strong driver, nevertheless the participation in the energy transition is driven more by energy saving and collective benefits rather than seen as an investment (i.e. people are aware they will not become rich, whatever their participation in the energy market would be).
2. Even if it is only a trend, apparently respondents living in rural contexts, prefer small renewable energy systems in their own property while people living in densely populated area tend to prefer medium local energy production plants.
3. Installing a Small renewable energy production system in own property allowing to sell the extra amount to the network is the option chosen more frequently by respondents while shared collective consumption from a local energy production plant appear as the less appealing option.
4. Answers to this section may be biased by the framing of the questions, not mentioning in detail what "collective and shared" consumptions stands for and unavoidably failing in describing the large amount of different possible energy echosystems (e.g. Local Energy Communities). To this concern, it is important to underline once again that to full transparency and avoiding jargons when disclosing information about energy systems may result in higher acceptance than oversimplification.

source: https://www.pexels.com// || author: fauxels

>1.6 Main findings and recommendations

As a general consideration the **"RENAISSANCE survey"** on renewable energies and community-based solutions showed show that while new business models are still finding their way through the future energy market echosystem, people are ready to leave the business as usual towards innovative solutions, despite their low awareness of its complexity.

> 1.7 Conclusions

The results of this survey allow not only energy stakeholders and decision-makers understand better the real conditions in which the RENAISSANCE project and many others are applying their research. We collected information directly from the citizens to be able to give accurate and helpful information about the energy transition to whom it concerns the most: themselves.

European citizens rely less and less on single information channels, while they show instead a positive tendency to combine different sources. This approach can either result in a higher feeling of confusion due to contradictory information, or it can represent an appropriate strategy to gain a more comprehensive perspective about the energy transition.

With friends and close connections as main source of information, creating more or less institutional occasions for sharing direct experiences should be explored as a first step to increase the possibility that people will connect with more “formal” or “scientific” knowledge afterwards.

Informing and engaging since the design phases small groups of people, in order to later scale-up to the larger community, can represent a strategic choice when envisioning a stronger involvement in decision making. By doing so a small group of pioneers are empowered to advocate co-created initiatives or solutions, help building a common and understandable language, divert doubts and fears and finally have a stronger impact on the collectivity.

Concerning results and recommendations addressed to policy-makers, regulators and all energy market actors, our suggestion is to expand the research about the decision-making processes and the related expectations of involvement by the citizens. Already in this report we underlined some sensitive points that can be improved:

1. Improve the general level of awareness concerning mutual dependences of environmental issues, economical aspects and energy value chain;
2. Identify the gaps between the current regulatory landscape and to what extent citizens are actually reached by comprehensible, clear and updated information about it;
3. Increase the accessibility and effectiveness of information regarding energy transition incentives that actually reaches end-users;
4. Support the implementation of innovative energy business models and capacity building both in public and private sector by promoting consensus building across local administrations, energy market actors and consumers;

Next steps

This survey is only a first step in the development of stakeholder engagement strategies within RENAISSANCE. The project's communication and dissemination strategy will continuously adapt and try to overcome some of the identified barriers by offering better descriptions of energy echosystems, emerging business models, thus supporting more informed choices.

Hopefully insights will be useful to other projects with complementary goals: further research inputs can be derived from unanswered issues, considered out of scope by this survey.

Future research

1. The survey will be slightly modified and launched two more times, to gain insights on a two year timescale:
   - One focusing on the pilot sites stakeholders segment, especially local energy consumers;
   - Lastly to the wide public and to pilot sites stakeholders, to receive final insights about awareness and acceptance levels.
2. Results from the survey will be analysed and compared with MAMCA analysis and stakeholder needs and expectations;
3. Results from the survey will be compared with similar or complementary EU and extra-EU researches.

>Annex I: business models descriptions

This annex provides the extended textual descriptions of Business Models, as they were presented in the online available interactive survey. During MAMCA workshops a more detailed description of suitable business models depending on the specific context were provided and explained to involved market actors and affected stakeholders. A common reference for initial categorisation is the work of M. Arentsen and S. Bellekom (2014), further developed to create scenarios fit to the local stakeholders' needs (Figure 39).

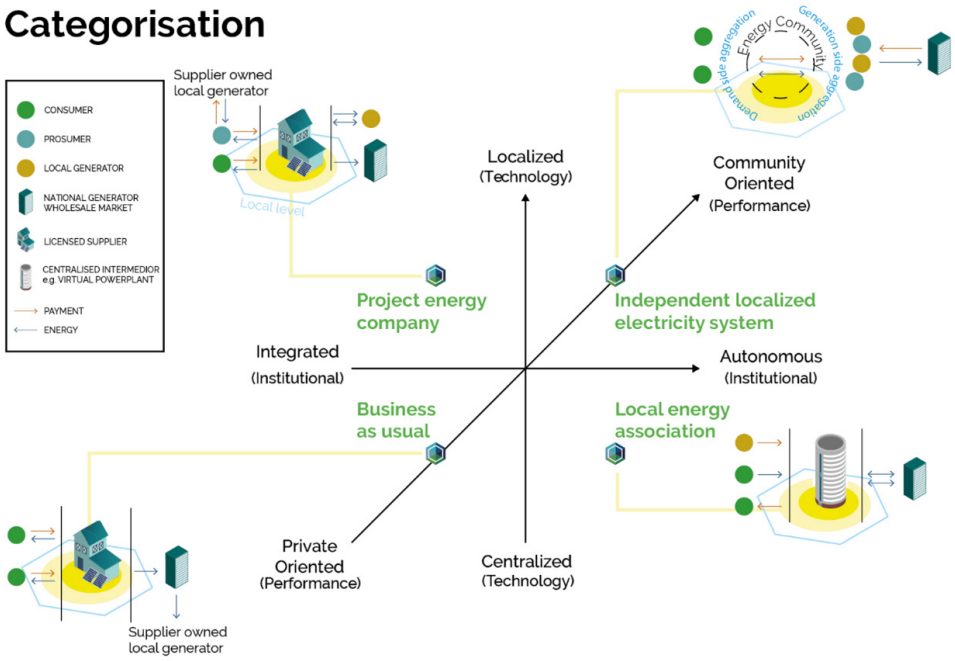


Figure 39. Graphic developed by RENAISSANCE and freely inspired from: M. Arentsen and S. Bellekom, Power to the people: local energy initiatives as seedbeds of innovation?, Energy Sustain. Soc., vol. 4, no. 1, p. 2, 2014

Tabular I – KEY

Each model was expressed through 5 key characteristics:

1. Location of assets
2. Size
3. Kind of investment
4. Energy trading model
5. Decision making process

Prosumer Model (Local prosumers' energy company)

1. Prosumers are incentivized to install production systems in their own property.
2. Small sized system (e.g. solar panels on rooftops, small scale wind or geothermal systems).
3. Prosumers invest in their own energy production system for own consumption.

4. Energy is produced with the aim of collecting revenues; surplus energy is directly fed into the grid and remunerated by the central grid system operator for a set tariff.
5. The involvement in decision making is low. Beyond from the initial choices about investment and amount of energy traded, there is no power of decision on any other matter related to the energy production, consumption or trading. The amount of revenues collected by the prosumer/s depends on the amount of energy power installed.

Other kinds of organized prosumer model (e.g. P2P, virtual power plant, local energy association)

1. Energy end-consumers are incentivized to install production systems on their own property to become prosumers.
2. Small sized system (e.g. solar panels on rooftops, small scale wind or geothermal systems).
3. Prosumers invest in their own energy production system for own consumption. Energy is produced mainly to cover own consumption needs and to sell energy to end-consumers.
4. Surplus energy is traded directly to other consumers (e.g., the neighbors) or aggregated and sold to the wholesale energy market
5. The involvement in decision making is low. Beyond from the initial choices about investment and amount of energy traded, there is no power of decision on any other matter related to the energy production, consumption or trading. The amount of revenues collected by the prosumer/s depends on the amount of energy power installed.

Esco (Business as usual)

1. The energy supply company owns the energy plants that are dislocated locally.
2. Medium to large scale renewable energy plant.
3. Large investments from energy supply company owners are required. End-users are contributing to the return of investment simply buying energy from the company
4. Energy is produced with the aim of collecting revenues. Energy produced by the energy supply company is sold to the wholesale market. End-users pay their bill according to their current energy contract.
5. There is no involvement in decision making. Choices are taken by the management of involved actors and decisions follow the top-down flow.

Energy community (Community oriented)

1. Local renewable energy plants are installed in community member own property and/or dislocated in local available areas through a community decision process.
2. Small sized systems and/or medium scale systems.
3. Requires a shared investments from all members of the community. The amount of energy production assets installed cover the overall community consumption.
4. Energy is produced to cover community consumption needs. Surplus energy is aggregated and sold to the wholesale market, directly to other consumers or stored for future demand. Revenues are distributed among community members in a form of retribution or new investments.
5. The involvement in decision making is high. All members of the community have the right to vote on issues concerning the use of collected revenues, new investments and market strategy.

> Annex II: Links to the full translatted texts of the survey

English version of the Survey

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Renaissance

RENEWABLE INTEGRATION & SUSTAINABILITY IN ENERGY COMMUNITIES

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