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Attitudes Towards the Use of Renewable Energy Sources - The Case of Slovenia

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Abstract | Background: A shift towards renewable energy sources (RES) is needed to reduce humanity's carbon footprint. The measures for increasing RES are developed on multiple levels, from international policies to concrete developments of projects. They must all be well accepted in society for a successful energy transition (ET). Objectives: The aim was to compare the results of surveys on public attitudes towards ET and RES, particularly on the social acceptance of RES at different levels of consideration and in different measurement contexts. Methods: Triangulation of three data sources on different levels was made: The European Social Survey (ESS), measuring the general attitudes from a cross-country perspective; a national RES survey (as primary quantitative study) regarding the possible national RES scenarios - ranging from general attitudes to opinions about project development, and a qualitative in-situ survey of attitudes towards existing solar power plants as the most specific level. Results: The results from ESS show a discrepancy between accepting the existence of climate change on the one hand and responsibility on the other. National survey on attitudes towards RES shows growing public acceptance of wind and solar power plants but lower acceptance of hydropower across different scales of the survey. The key recognized advantage in wind and solar power plant is their environmental friendliness, while the main disadvantage is the unreliability of the energy source. The survey showed high levels of distrust of national politics in making good decisions about RES. The qualitative in-situ study revealed solar power plants as highly noticeable objects in the landscape, and that individuals often weigh the negative and positive impacts without clearly deciding which one prevails. Discussion: The results across all three surveys indicate high public agreement with the climate change paradigm across the scales but reticence toward tangible environmental measures, especially as the survey context moves from general and abstract towards local and specific. The results indicate a strong material conditionality in forming public attitudes towards energy policy and weak environmental empowerment, further fuelled by low institutional trust in Slovenia. To better understand social acceptance across scales and methodological implications of different measurements, more such comparisons are needed to draw universal or definitive conclusions. Conclusion: Looking at Slovenia's positioning in the European environmental value framework that Slovenia is at a crossroads between European countries with high levels of acknowledgement of the existence of climate change and countries with a pattern of weaker acceptance of the climate paradigm and more concrete decarbonisation measures. In several respects, the results of the primary RES survey suggest that the direct or indirect economic benefits of RES are more often chosen than the environmental benefits. Authors stress that environmental transformation (including RES implementation) will not be successful without a broader societal transformation that ensures an equitable distribution of benefits and risks.

Keywords | climate change, renewable energy sources, European Social Survey, public opinion, wind farms, solar power plants, siting of energy installations

Introduction

Climate change is one of the most critical challenges of current times. According to most scientific and professional stakeholders, climate change threatens the environment and increases the risk of loss of quality of life or life itself. The severe consequences of the increasing frequency and intensity of extreme weather episodes have also been well demonstrated in Slovenia during several successive catastrophic floods. In order to prevent further adverse impacts, particularly from human influence on the climate, significant reductions in greenhouse gas emissions would need to be achieved in a relatively short period of time (IPCC, 2023) [1].

This objective requires significant steps on several fronts. These range from developing and deploying new low-carbon technologies, to a general transformation of production, reduction of consumption and change in lifestyle habits. These should all be framed by new environmental policies. One of the key measures in reducing the carbon footprint is a shift towards using renewable energy sources (RES), which would also be acceptable to the public. There are multiple levels in the measures to increase the use of RES, from international policies to specific developments of projects. They all need to be well accepted in society in order to make the transition from fossil fuels to RES. In the REPowerEU program, the European Union set a binding target of a 42.5% share of renewables in overall energy consumption, almost double the existing share (Directive EU 2023/2413). The Directive obliges member states to designate renewable acceleration areas where renewable facilities are priority and where individual projects could even bypass environmental impact assessments. The Directive has been transferred to the Slovenian legal system through the Act on the Deployment of Installations for the Production of Electricity from Renewable Energy Sources (ZUNPEOVE, 2023), which further details how the acceleration areas will be established. Both EU and Slovenian legislation emphasise the importance of environmental acceptability of acceleration areas without mentioning social acceptance; a part likely to play an equally important role in the designation of these areas. However, they do introduce specific mechanisms that could be used to increase acceptability such as energy communities and financial compensation. Better understanding and greater knowledge of the social attitudes towards renewable energy production can contribute to better planning of it and consequently facilitate the implementation of appropriate environmental policies. Social acceptance is one of the critical links in the broader process of this transformation and will be the focus of this article.

This paper aims to look at public attitudes towards energy transition at different levels of public acceptance. The study examines the results of three studies carried out at three different levels; the European Social Survey which surveys the general attitudes from a cross-country perspective; a national RES survey regarding possible national RES scenarios (from general attitudes to opinions about project development) and an in-situ survey of attitudes towards existing solar power plants as the most specific level.

The paper starts by looking at the general environmental value profile of the public in Slovenia. In particular, accepting the existence of climate change and understanding the causes and possible actions.

Environmental attitudes in a comparative perspective

The acceptance of the climate paradigm[2] in the international environment reflects the complexity of the issue. This is reflected in the varying degrees of recognising climate change as a scientific fact and its associated consequences. With the growing distrust of science and its marked increase since the pandemic period, denial of the climate paradigm has manifested itself in various socio-cultural environments, political contexts and especially on various online platforms. This has been either in the form of scepticism (science does not have enough reliable data, it is a natural climate fluctuation, etc.) or conspiracy theories (climate science is politically motivated, with economic lobbies trying to take control of society and the energy resources behind it). In spite of this however, the vast majority support the view that climate change is happening and that it is more or less certain to be caused by human activities (Powell, 2019). In the European context (where scepticism is generally lower than in the US, for example), there are some

differences. The different socio-cultural environments with different economic traditions and energy legacies have led to different value systems, reflecting the varying attitudes towards climate change and energy use (Stern, 2000).

The 8th round of the European Social Science Survey (ESS 2016-2017) included a special thematic module on public attitudes to climate change and energy use in more than twenty countries. This was called Public Attitudes to Climate Change, Energy Security and Energy Preferences (ESS Round 8, 2016)[3] and focused on dilemmas related to climate change and energy use. It was also linked to the development of the Paris Agreement which was shaped in 2015 and 2016 and laid the foundations for global guidelines in tackling climate change and sustainable development, with a particular focus on using renewable energy sources.

In order to illustrate where Slovenia fits in to the overall value framework on climate change, it is necessary to look at the comparative display of the two starting questions in the ESS module. Firstly, (A) *You may have heard the idea that the world's climate is changing due to increases in temperature over the past 100 years. What is your personal opinion on this? Do you think the world's climate is changing?* For question A, Table 1 shows the proportion of responses with answer 1 (definitely). Secondly, (B) *Do you think that climate change is caused by natural processes, human activity, or both?* In the table, the second column gives the sum of the proportions for answers 4 (mainly human) and 5 (entirely human).

Table 1: *Proportion of responses for questions A and B by country (%)*

		(A) Climate ... is definitely changing
		%
1	Portugal	76,97
2	Iceland	75,14
3	Spain	74,41
4	**Slovenia**	**71,76**
5	Netherlands	67,25
6	Ireland	67,16
7	Switzerland	65,09
8	Belgium	63,95
9	France	63,31
10	Germany	62,39
11	United Kingdom	61,68
12	Sweden	60,31
13	Italy	59,10
	Average	56,81
14	Austria	55,11
15	Israel	52,01
16	Poland	49,51
17	Norway	48,86
18	Hungary	48,42
19	Lithuania	43,55
20	Estonia	41,93
21	Finland	41,17
22	Czech Republic	40,84
23	Russian Fed.	38,21

		(B) Climate change caused ... entirely or mainly by human activity
		%
1	Austria	61,5
2	Spain	60,1
3	Italy	57,0
4	Iceland	55,8
5	Germany	54,6
6	Belgium	53,4
7	Finland	51,9
8	Sweden	51,9
9	Portugal	49,8
10	France	47,7
11	Hungary	47,3
	Average	45,7
12	Netherlands	45,2
13	Switzerland	45,0
14	Israel	42,8
15	Ireland	39,9
16	**Slovenia**	**39,2**
17	Norway	38,2
18	United Kingdom	37,2
19	Czech Republic	37,2
20	Estonia	35,1
21	Lithuania	34,1
22	Russian Fed.	33,6
23	Poland	32,0

Source: 2016 ESS Round 8. Post-stratification weights were used to calculate country-level shares.

If the 23 countries are ranked in terms of their expressed level of acceptance of the climate change paradigm, it can be seen that Slovenia ranks high in the first question (4th place) but moves down to 16th place out of the 23 countries for the second question. For the first question about whether the world's climate is changing, a deliberate decision was made to use *definitely* as the only indication to show the proportion of responses. Indeed, if *probably* had been used, virtually all countries would exceed 90% acceptance of the fact that the climate is changing. The differences are more pronounced if the answer *definitely* is used. The range varies from a group of countries with a high share above 70% (Portugal, Iceland, Spain and Slovenia) to almost all Eastern European countries, Norway and Finland where the share is below 50% (the average among countries is around 58%). In the second question about the impact of human

activity, the level of agreement about the causes of climate change shows a somewhat different picture. In this case, only answers 4 (mainly human) and 5 (entirely human) have been used as the initial measure as these clearly express that climate change is the consequence of human activity. In a similar way to Slovenia, a few more countries slip from a higher ranking in the first question (e.g. Ireland, Switzerland, the United Kingdom and the Netherlands) to a below-average or lower ranking segment in the second question. Slovenia is in fact, the only non-Western European country to make such an apparent change of position. All other Eastern European countries (as well as Estonia, Lithuania and Israel) remain in the lower segment for both questions. Therefore, it seems that Slovenia is in an in-between space where the dissonance between the first and second sub-topics (comparatively between countries) is among the most pronounced. In a way, this duality is symptomatic of the wider European area and shows that accepting the existence of climate change is easier than accepting responsibility. Indeed, the latter requires changes in attitudes and lifestyles. It may also reflect 'optimism' that the consequences of climate change will not be so severe that we need to worry or that they will be solvable with new technological solutions. This is also confirmed by the data (ESS Round 8, 2016) on the impacts that climate change will have. The vast majority of countries that either agree with both premises to a lesser degree or are in dissonance between the two also identify the consequences of climate change as being *bad* to a lesser degree.

Like most European countries, Slovenia accepts the warnings of the environmental sciences and international environmental institutions. However, dilemmas arise when more specific support for environmental policies or actions, including some self-limiting principles, are expected. This high level of support subsequently slips into reservations and non-support for certain specific policies, even in environments where the majority accepts the climate paradigm in principle. This is also confirmed by the data looking at issues that measure support for more specific environmental measures such as: subsidies for renewable (RES) energy investments, enacting a law banning the sale of less energy-efficient household appliances or increasing taxes on fossil fuels (ESS Round 8, 2016).[4] The most popular measure is the public funding of various subsidy models. This is supported by three-quarters (75%) of the European population and was also most supported initiative in Slovenia. A lower but still considerable share (60%) of Europeans supports the introduction of a law banning the sale of less energy-efficient household appliances. By far the least popular measure is increasing taxes on fossil fuels (oil, gas and coal); a measure considered one of the most effective. It has a significantly higher share of opponents (44%) than supporters (30%), with higher support in some Western European countries and especially Nordic countries. A more detailed analysis has revealed that higher fossil fuel taxation enjoys greater support in environments with a high degree of trust in systemic institutions (Otto & Gugushvili, 2020). This is mainly the case in the Nordic countries and Western European countries that historically and politically exhibit a social democratic tradition, where progressive environmental measures go hand in hand with the concern for a just society (Fritz & Koch, 2019).

The Climate Change cross-national data (ESS Round 8, 2016) shows similar differences between countries regarding definitions of energy preferences and attitudes towards renewables. Some typical regional and historical-political formations have emerged, suggesting that existing energy supply regimes, their infrastructural legacies, as well as natural resources across countries are strong determinants of shaping peoples' environmental views (Balzekiene & Telesiene, 2016).

The next part of the paper will move towards a more detailed analysis of the attitudes of the Slovenian population towards RES. This can be a starting point showing where Slovenia is positioned in energy preference. This issue has become particularly acute since the start of the war in Ukraine, with rising energy prices, persistent dependence on fossil fuels and the EU's increasingly ambitious push for more renewables.

In terms of support for different energy sources in general, it can be seen that about two-thirds of Europeans think that the vast majority of electricity should be generated by hydroelectric or wind power while three-quarters chose solar energy (renewables). In the following section, it will be seen that this support is also vital in Slovenia and is growing over time. Support for hydropower is somewhat different however. In other European countries, support for

hydropower was around 66% on average while in Slovenia in 2016 (ESS Round 8, 2016) this support was only 59%, declining to 51% in 2019 (Hafner Fink, 2021). In contrast, it is evident that coal and nuclear energy are distinctly unpopular energy sources among Europeans. Coal and natural gas have the highest support in Israel and several Eastern European countries, where nuclear energy also enjoys higher support (Russia, Lithuania, Hungary). Correspondingly, support for renewables is typically lower in these countries and especially in Russia.

Attitudes towards renewable energy in Slovenia - a starting point

The use of RES is seen as one of the critical public policy measures to mitigate the climate crisis. One of the vital parts of the EU's development paradigm is to increase the share of energy from renewable energy sources (RES). Both the EU and its member states are implementing and strengthening policies that aim to accelerate the deployment of RES. The EU has recently adopted the Renewable Energy Directive (EU Directive/20232413) which requires member states to identify priority areas for the construction of RES installations. Within this framework, Slovenia has adopted the Act on the Deployment of Renewable Energy Installations (2023), placing it in their legal system.

While legislative support for increased RES deployment is growing, there is often opposition from the general public, especially when specific projects are built. In their model of social acceptability of RES, Wüstenhagen et al. (2007) highlighted that it is built from market acceptability, political acceptability and acceptability in local communities. Research has shown that the public is generally supportive of RES. In the EU, 92% of people favour increased use of RES (European Commission, 2019), so the success of transitioning to renewable energy sources may initially appear to be a technical question of finding suitable potentials and technological solutions. However, the implementation of specific projects is often met with local and broader public disapproval. As such, the transition to RES is not only a technical problem but also a broader societal challenge (Pasqualetti, 2011; Otto & Gugushvili, 2020) which requires the co-ordination of different disciplines as well as the general public. This has also been reflected in the Slovenian National Energy and Climate Plan (Government of the Republic of Slovenia, 2020: 48) which cites opposition from the general public as a constraint to accelerating RES deployment.

In order to explain such public resistance, researchers initially looked at the "NIMBY" (*not in my backyard*) phenomenon. However, opposition today is more often associated with place attachment and concerns for local identity and quality of life (Bevk & Golobič, 2020; Devine-Wright, 2009; Wolsink, 2000). The issue of ownership of RES installations and the sharing of benefits and harms between stakeholders is also becoming increasingly important (Goedkoop & Devine-Wright, 2016; Wüstenhagen et al, 2007). The development of RES is associated with many externalities such as loss of aesthetic value of the landscape, noise pollution and property depreciation which concern both the local and wider public (Krekel & Zerrahn, 2017; Droes & Koster, 2016).

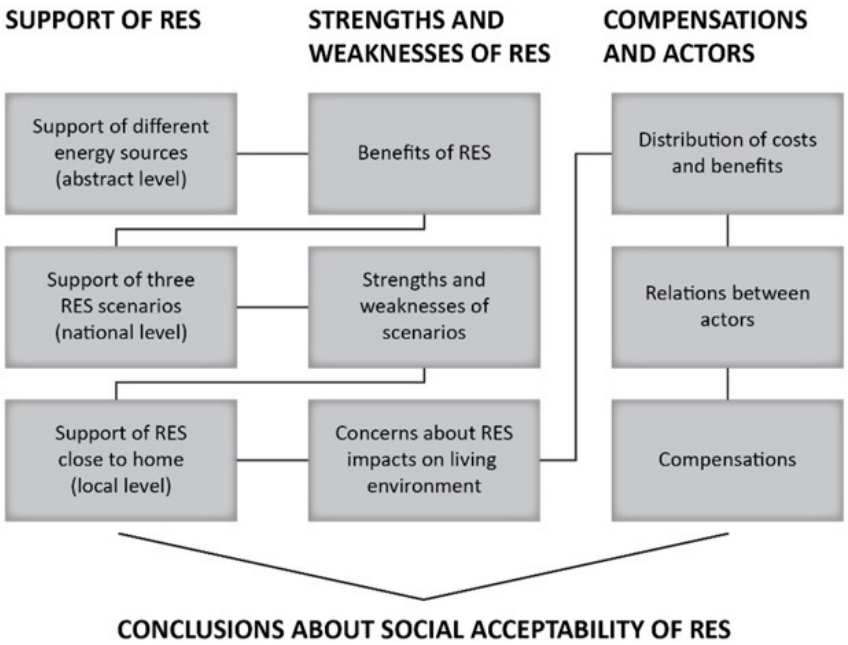
These starting points show the complexity of energy transition and the way it cuts across different scales. These range from the supra-national and national level with policy and strategy making through to the local level and individual level impacts on the environment and quality of life. It is necessary to adopt a holistic approach when exploring options for the efficient implementation of RES. This should take into account as many of these factors as possible and follow a hierarchy of criteria from the design and comparison of RES development scenarios at the national level to individual views on the siting of RES facilities. The following section of the paper will present the results of a survey that demonstrates this complexity. This covers the question of general support for RES based on national scenarios, to the level of the individual projects. In particular, exploring public attitudes towards the spatial implications of increasing RES use. The aim was to test public opinion on the effects of different RES scenarios (wind, solar and hydro scenarios), identify their perceived advantages and disadvantages as well as the impact of different compensatory measures on the acceptability of using RES. The findings are also compared to an *in-situ* study on attitudes towards landscapes of a solar power plant as a way of gauging people's perceptions of particular impacts of renewables development at a more detailed level.

Method

Despite the initial social science starting point of the research, the topic and approach are distinctly interdisciplinary. Indeed, the study Social Acceptability of Spatial Effects in RES Use Scenarios (Golobič, 2018) was carried out within a multidisciplinary framework studying the social and environmental aspects of renewable energy. There was also a module dedicated to the social acceptability of RES use, comprising approximately 120 variables, which was then included in the implementation framework of the Slovenian Public Opinion Survey (Slovensko javno mnenje) in 2019 - SJM19/1[5]. The development of the instrument and data collection (surveys) were coordinated by the Centre for Public Opinion and Mass Communication Research at the Faculty of Social Sciences (University of Ljubljana).

The questionnaire was accompanied by graphic and photo annexes which were used during the interviews. In addition to examining the acceptability of specific technologies and scenarios of RES in Slovenia, the survey also examined the reasons for supporting a particular scenario, its negative environmental impacts, the impact of the importance of offsetting factors on its acceptability, and the views on the relationships between different stakeholders in its planning (Figure 1).

Figure 1: *Questionnaire design for surveying social acceptability of renewable energy scenarios*



Source: authors' elaboration

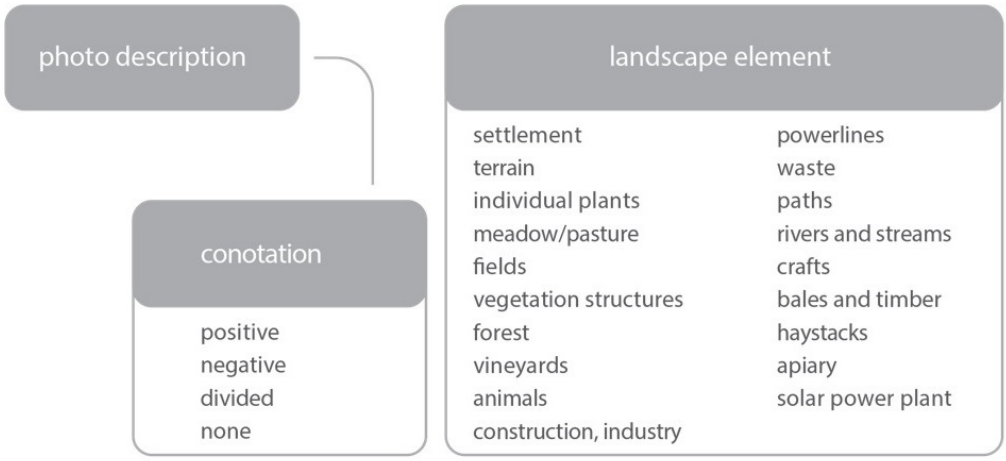
In addition to RES, the overall support for other energy sources (coal, natural gas, nuclear) was also measured. The same set of question was used as those in the 2016 European Social Science Survey in the Climate Change module (ESS Round 8, 2016; Kurdija et al., 2018). As such, it is possible to make a cross-temporal comparison between 2016 and 2019. The acceptability of three different RES scenarios was measured with each based on a different mix of solar, wind and hydro. It is important to note that the scenarios were based on existing documents, notably the Renewable Energy Action Plan (Ministry of Infrastructure, 2017; hereafter AN-OVE). The solar scenario was based on the large-scale construction of solar power plants, the wind scenario on large-scale wind farms and the hydro scenario exploiting the most potential hydropower plant sites in Slovenia. For each scenario, a spatial model was made showing where each resource would be exploited in Slovenia (Annex 1). The locations for wind and hydro were taken from the draft AN-OVE, while the solar plants were distributed according to settlement areas (rooftop plants) and a model of the annual quasi-global irradiance of the ground across Slovenia (Rakovec et al., 2008). The models were built solely for the purpose of being included in the SJM opinion poll and were simplified accordingly. For each scenario, a multiple-choice question was also used to identify its key strengths and weaknesses. The set of possible answers was prepared based on a review of the most frequently highlighted strengths and weaknesses of each source in the literature.

The acceptability of solar and wind farms was also measured. This was done at a specific, local level in the first case or installed close to the respondent's home in the second case. In order to help answer the question, a photosimulation was prepared for each technology showing the essential visual characteristics of the intervention. The basis for the photomontage was chosen in the form of a photograph which was judged to show a relatively anonymous Slovenian landscape. In one case, there were wind turbines inserted and in the second, a ground-mounted solar plant (Annex 2). Although the strategic guidelines advocate the construction of rooftop solar plants, ground-mounted construction is not excluded. In this study, it was decided to highlight ground-mounted installation as it is of interest to look at views on developments with potentially larger spatial impacts. For each specific photo simulation, respondents were asked about their concerns about the potential negative aspects of each situation and their views on sharing the benefits and harms between the different stakeholders. In the final part of the questionnaire, the impact of the different forms of compensation were examined as well as the relationship between the different actors in the decision to install wind or solar sources.

The primary survey instrument was a standardised questionnaire (with mainly 5-, 7- and 11-point Likert scales), adapted for data collection through a computer-assisted personal interview (CAPI). The survey methodology fully followed the established principles of conducting the Slovenian Public Opinion Survey. This uses the Central Population Register and a probability sampling method as the sampling frame. By the end of the survey, 1079 persons had completed the survey, indicating a response rate of 54% (SJM 19/1, Hafner Fink, 2021). It is a quantitative type of population representative survey which closely mimics the structure of the surveyed population (the population of Slovenia aged 18 and above) in terms of all key criteria: gender, age and employment status, as well as geo-spatial characteristics: region, settlement size and degree of urbanisation.[6]

In order to measure individual attitudes to the most specific impacts of energy transition, some survey findings were compared with a (previously made) *in-situ* survey on the perception of existing landscapes with solar power plants through the direct experience of the respondents (see Bevk & Golobič, 2020 for details). In this study, 28 participants were divided into three groups, each taking a 30-minute walk through a landscape with ground-mounted solar plants over a day. Participants were given cameras and notebooks and instructed to take up to ten photographs during the walk, showing motifs they considered to be characteristic, beautiful or disturbing in the landscape as well as writing down the reasons for taking the photograph. The instructions given to the participants did not mention solar plants and they were only informed that this was a landscape perception survey. The collected photographs and descriptions were later analysed in terms of their connotation, exposing how people perceive solar power plants in the landscape (Figure 2). It is important to note that with a limited sample size and a specific geographic context, this study cannot be considered an alternative or substitute for the primary study. Indeed, it is an entirely different type of research; its findings cannot be used to make statistical generalisations as it is not representative. However, this was not the aim of the study and its purpose was rather to provide qualitative insights into the factors influencing perceptions of renewable facilities in the landscape. The study serves to complement the primary research findings by capturing participants' spontaneous reactions on-site in the environment.

Figure 2: *Description of coding system*



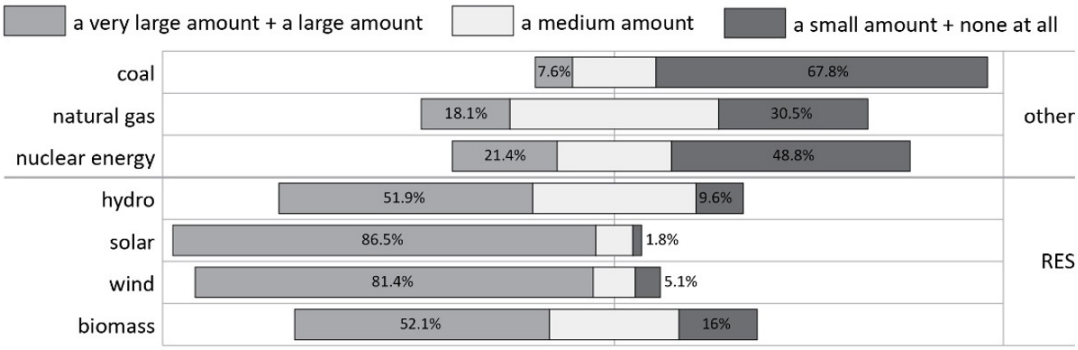
Source: authors' elaboration.

Results

According to the majority of respondents in the primary RES survey (Hafner Fink, 2021), Slovenia should produce *a large amount* to a *very large amount of energy* from renewable energy sources (hydro, wind, solar and biomass), with almost 68% of all respondents choosing these two answers. The highest proportion of responses for non-renewable sources (nuclear, natural gas, coal) ranges from *none at all* to *a medium amount*, with the latter dominated by nuclear (24.9%) and coal (29.2%). There is a high level of support for renewable energy sources, especially solar and wind, and

a significantly lower level of support for non-renewable energy sources (nuclear, natural gas, coal; Figure 3)

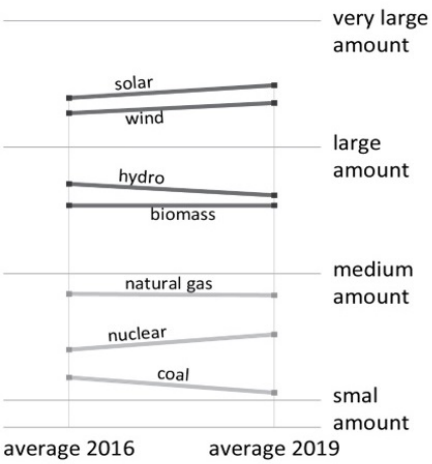
Figure 3: *Distribution of responses to the question: How much of the electricity used in Slovenia should be generated from each energy source? (repeated question from ESS 2016)*



Source: SJM 2019/1; own calculation.

There was a similar distribution of answers found in the climate change module in the 2016 European Social Science Survey (ESS Round 8, 2016; Kurdija et al. 2018). With the exception of hydropower, the average support score for all renewables increased (Figure 4). Support for hydroelectric power fell slightly (- 7.5 percentage points or 12.6% for *very large amount* and a *large amount* sumed) and for coal and natural gas as well, while support for nuclear power rose slightly (+ 4.9 percentage points or 29.7% for answers *very large amount* and a *large amount* in sum). The proportion of *don't know* responses also increased for all energy sources. The differences in the mean scores for coal and solar energy are statistically significant.

Figure 4: *Comparison of averages for the same question on overall support for different energy sources in 2016 and 2019*



Source: ESS round 8, SJM 2019/1; own calculation.

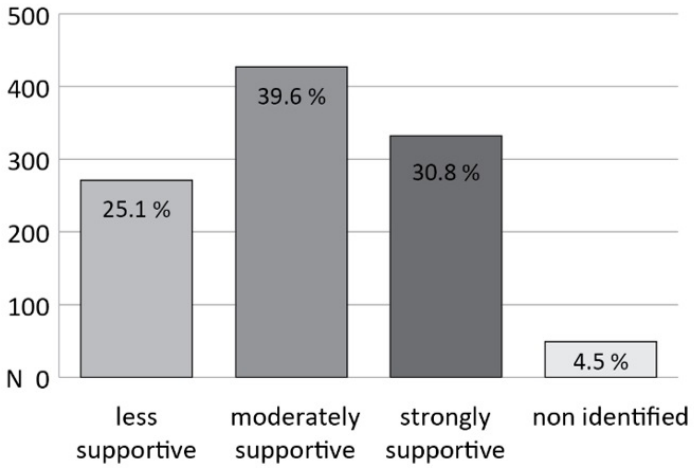
Based on the responses, an index of the RES preference for each respondent was created. The index has been constructed using a scoring method whereby a certain number of points were assigned to each response indicating support for RES or rejection of fossil fuels and totalled up (Table 2). A higher score indicates a higher level of support for RES. The respondents were divided into three classes according to their scores: less supportive (scores from 1 to 6), moderately supportive (scores from 7 to 9), and strongly supportive (scores from 10 to 15). Those who did not fit into the index (49 cases) were marked as unidentified. Most respondents were classified as moderately supportive (39.6%), followed by strongly supportive (30.8%) and less supportive (25.1%). (Figure 5)

Table 2: *Scoring of responses for the RES Attitudes Index*

	very many	many	medium	little	nothing at all
coal				1	2
natural gas				1	2
nuclear energy				1	2
hydropower plant	2	1			
solar energy	3	2			
wind energy	3	2			
biomass	1	1			

Source: author's elaboration.

Figure 5: *Respondents' ranking in the Renewable Energy Sentiment Index*

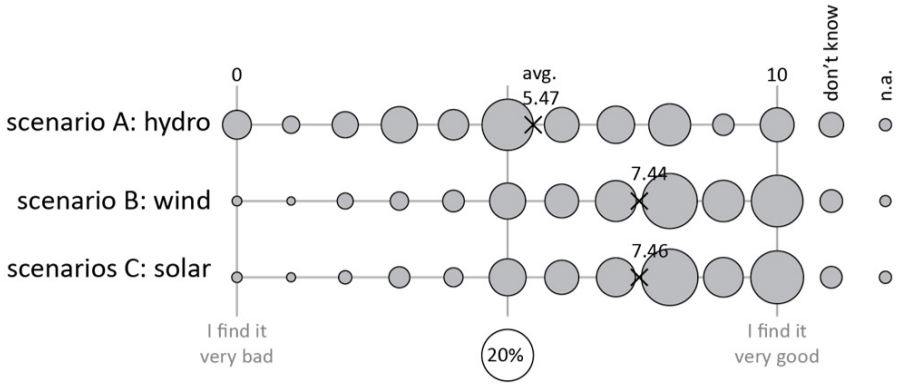


Source: author's elaboration, own calculation.

When asked about the most significant benefits of using RES, the answers *lower greenhouse gas emissions* (37.3%) and *these sources are unlimited, renewable* (22%) stand out. Furthermore, *these sources are more friendly to plants and animals* and *better energy self-sufficiency* were selected by 15.3% and 12.2%, respectively. In addition to the answer *I don't know*, the lowest number of respondents chose the answer *this energy is cheaper* (8.4%).

A comparison of the respondents' ratings of the map scenarios (Annex 1) shows that the wind and solar scenarios are considered similarly good, with an average rating of 7.44 and 7.46 respectively (on a scale from 0 to 11 with a higher value indicating better; Figure 6). Their similarity is also shown by their frequency distributions which almost overlap. However, the scenario based on hydropower received an average score of 5.47 (Figure 6). It also shows a noticeably higher number of responses at the extreme negative pole of the scale (*it does not look good to me at all)*, indicating a greater polarisation of views on this energy source.

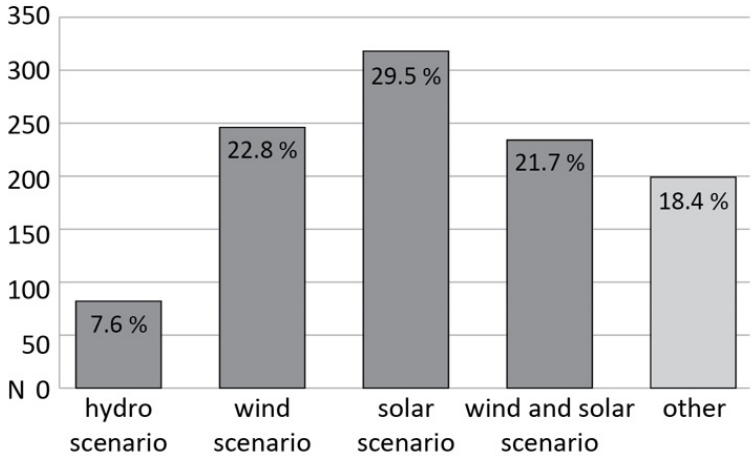
Figure 6: *Comparison of support for RES scenarios in Slovenia*



Source: SJM 2019/1, own calculation.

In a similar way to the RES preference index, a scenario preference index was created by ranking the scenario ratings for each respondent. The ranking shows which scenario is most preferred (Figure 7). Given the similar answers for the wind and solar scenarios, one group represents those respondents who find the wind and solar scenarios better than the hydro scenario. The proportion of respondents who do not show a clear preference and could not be reliably assigned to one of the groups (other) is 18.4%.

Figure 7: *Distribution of respondents in the index of preferred scenarios*



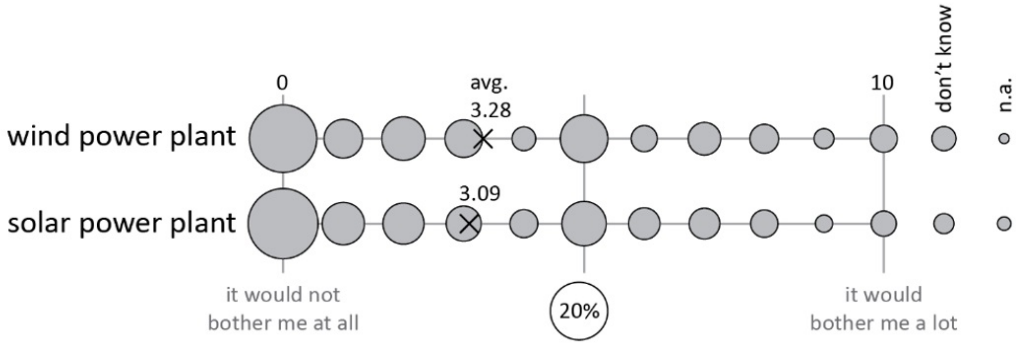
Source: SJM 2019/1, own calculation.

A further point of interest is where the respondents see the key strengths and weaknesses to be in these scenarios. The main advantages of the hydro scenario were seen to be the resource's reliability (27.1%) and the *increase in the country's level of energy self-sufficiency* (23.9%). The main disadvantage of the hydro scenario was the opinion that *hydroelectric power plants are harmful to the environment* (31.3%). The next most frequent substantive answer was that *hydropower plants are not in appropriate locations* (17.6%). In the *other* category (6.1%), environmental aspects such as *impacts on ecosystems*, *flooding* and *overloading of certain rivers* were mainly highlighted. The prevailing advantage for both wind and solar scenarios is the *environmental friendliness* (wind 34.1%, solar 32.7%), followed by the answer that *this energy* is *cheap* (wind 25.1%, solar 20.7%). Among the disadvantages, the highest number of responses was that *wind/solar power plants are not a reliable source of energy* (wind 29.2%, solar 23.7%) while 13.4% of respondents considered that *wind power plants are not in suitable locations*. 15.2% of respondents considered solar energy *expensive.* In terms of the *other* responses (8.4% for wind and 10.7% for solar), the main responses were that they did *not see any disadvantages in the scenario*. The wind scenario raised the issue of the impact on birds, noise and the visual impact on the environment. The solar scenario highlighted waste and the risk of fire.

There was also strong support for wind and solar power at the local level in the RES survey. The respondents were asked to rate how much they would be disturbed by a solar and wind farm in the vicinity of their home and were

shown a visual representation of each (Annex 2). It turns out that most respondents would not be unduly disturbed by either facility. 59.8% of the respondents placed their answer for the wind farm on the left-hand side of the scale, where the highest share is noted at the far pole (27.5% - *would not disturb me at all*). The response in the solar farm case was similar with 62.8% of respondents choosing *would not disturb me at all*. The most positive value at the far pole received 29.7% of the answers.). The average scores (on a scale from 0 to 10) were 3.28 for wind and 3.09 for solar (Figure 8). These two results also reflect high support for wind and solar power which is consistent with the previous questions.

Figure 8: *How much would you be bothered by the presence of a wind or solar farm near your home?*

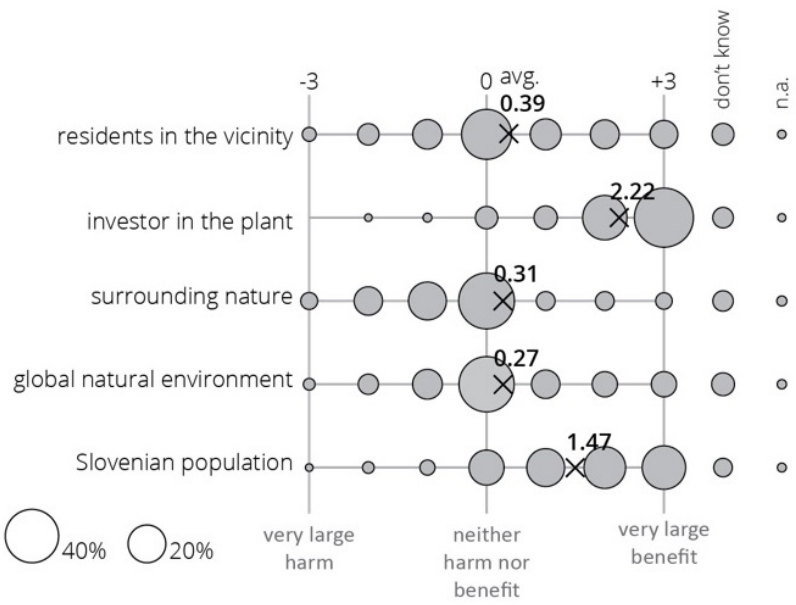


Source: SJM 2019/1, own calculation.

There were no aspects which stood out as being a single cause for concern when living near a wind or solar farm. For wind farms, the respondents would be least concerned about the *unnecessary use of money and space* (mean: 1.74) and *shadow flicker* (mean: 1.78). This was measured on a scale from 1 - *I would not be concerned at* all to 5 - *I would be very concerned*). The respondents would be most concerned about *noise* (mean: 2.44) and *property values* (mean: 2.25). In the case of the solar power plants, they would be least concerned about *noise* (mean: 1.34), the *impact on human health* (mean: 1.84) and the *unnecessary use of money and space* (mean: 1.87). They were most concerned about *glare* (mean: 2.50) and *the appearance of the landscape* (mean: 2.42).

The structure of the responses in terms of the benefits of different stakeholders from RES development is also very similar for wind (WPP) and solar power (SPP) (Figure 9). The predominant opinion is that the investor benefits *very much* (mean: 2.22 for WPP and 2.33 for SPP; on a seven-point scale from -3 to 3). However, residents in the vicinity of the plant *neither benefit nor are harmed* (mean: 0.39 for WPP and 0.53 for SPP). For the population in general, the opinion tends to lean towards *benefit* (mean: 1.41 for WPP and 1.41 for SPP, respectively; on a seven-point scale from -3 to 3). The opinion on benefits and harms for the surrounding nature (mean: 0.31 for WPP and 0.29 for SPP) and the global natural environment (mean: 0.27 for WPP and 0.25 for SPP) falls around the middle of the scale - *neither benefit nor are harmed*. Therefore, the benefits are mainly attributed to investors and partly to the general population as well.

Figure 9: *Average responses on the harms and benefits for different actors in the construction of a wind farm (WPP)*



Source: SJM 2019/1, own calculation.

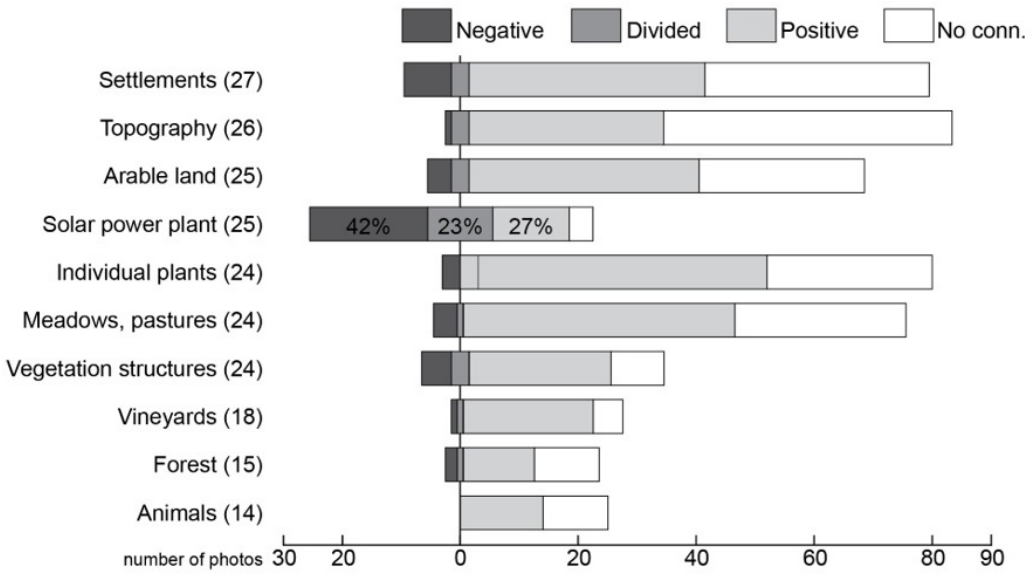
With regard to the amount of power each actor should have in decision-making when siting solar or wind power plants, the respondents showed high trust in experts (average score 4.36) on a scale from 1 – 5 (where 1 represents the least say and 5 represents the most say in the matter). This was followed by residents in the vicinity (average 3.90) and the investor (average 3.26). The responses showed low trust in politicians, both at the local (average score 2.50) and national level (average score 2.18).

In terms of the offered compensation to support the construction of a solar or wind farm, the largest share of respondents chose the *investment of the owner of the power plant in local development* (53.8%), followed by *direct financial payments (in the form of a lump sum or a monthly annuity)* (20.8%). 15% of the respondents chose *profit-sharing.*

Findings of the 'in-situ' survey

A comparison of the survey results with the perceptions of landscapes with solar power plants adds some more complexity and nuances to the issue. In the actual landscape experience, solar power plants were among the most prominent landscape features although they were also perceived significantly differently to other landscape features (Figure 10). While most landscape features were described with positive or no connotation, solar power plants were dominated by negative and divided connotations. The contrast between the results of the questionnaire and the *in-situ* survey can be attributed to the different ways of thinking of the participants in the two studies. The respondents in the RES survey may have remained at a more abstract level of thinking even when asked about the specific spatial implications of installing RES. As such, this may have led them to favour the positive impacts of solar power plants (low-carbon energy). On the other hand, the *in-situ* survey was strictly focused on the landscape and not on technology solutions or energy needs. Consequently, this may have led to respondents favouring the negative landscape impacts of solar power plants. In Slovenia, where the *in*-situ study was done, landscape is most often understood as a rural idyll, so the study's focus might have emphasized the contrast between this concept of the landscape on one side and modern technology on the other. However, many (ground-mounted) solar power plants will likely be located in such a spatial context in the future. As such, better understanding of potential opposition to these interventions can contribute to designing better processes for conflict resolution. Another important finding from the *in-situ* survey is that many participants highlighted both the positive and negative aspects of the solar power plant. As a result, it was impossible to form clear groups of supporters and opponents among the participants. The comparison between the two approaches shows the importance of framing the surveys and individual questions. This finding reopens the possibility of increasing the acceptability of solar power plant installations through carefully planned processes that justify each intervention and demonstrate the public interest and absence of adverse impacts.

Figure 10: *Connotations of descriptions of the most frequently photographed landscape elements*



Source: Bevk & Golobič, 2020.

Discussion and conclusion

The RES survey has shown high support for renewable energy sources in Slovenia, especially wind and solar power plants, suggesting that the social acceptance of RES is high.

The recognised benefits of RES mainly relate to their environmental impact. These have been identified as reduced greenhouse gas emissions, followed by the renewability of the resource and their perceived low impact on plants and animals. It is of interest that the energy aspects (self-sufficiency and price) are at the bottom of the scale. It should be added that a repeat of the study in the aftermath of the energy crisis (coinciding with the outbreak of war in Ukraine) would probably show different results. This suggests that self-sufficiency and price are quickly forgotten when people live in times of social and economic stability.

The advantages and disadvantages of the solar and wind scenarios paint a similar picture, with the hydro scenario being slightly different. With regard to the solar and wind scenarios, the most frequently chosen advantage was *environmental friendliness*, followed by the claim that *this energy* is *cheap*. However, the most frequently cited disadvantage was the *unreliability of the source*. When asked about the disadvantages of the scenarios, a significant proportion of the respondents also answered *"don't know"*. Given the prevailing view that the key advantages of solar and wind power stem from environmental considerations, it is surprising that the answers on the benefits and harms that these two technologies bring to the global natural environment are concentrated on the answer of *neither benefits nor harms*. This could be interpreted as them being perceived as the 'least bad solutions', where solar and wind farms are considered the only objectively available alternative to fossil fuel for generating energy. While these options do not benefit the environment, they do the least harm compared to other options.

Similarly, the finding that respondents think that investors benefit the most from power plants suggests that they mainly understand RES power plants as entrepreneurial projects. The social benefit aspects are somewhat less recognised. It seems that the prevailing perceived benefits mainly relate to the economic aspects with most respondents not thinking much about the environmental factors. A slightly different impression is given regarding hydroelectric power plants. Although the respondents consider them to be a reliable source that improves Slovenia's self-sufficiency, they are seen as more harmful to the environment. This is also linked to the clearly expressed opinion that (in the scenario shown) they are not in appropriate locations. It can be assumed that such views have been influenced by the media debate which has extensively reported opposition to some hydropower projects (on the Mura and Sava rivers). In this case, opponents have strongly highlighted the negative environmental impacts of hydropower

plants.

The high level of support for solar and wind power is also reflected at the local level in the RES survey. Most respondents would not consider living near a wind or solar farm to be a problem. The main concern would be noise from a wind farm while glare is the primary concern for solar farms. The decrease in property values in the vicinity was also mentioned in both cases. These aspects are also frequently highlighted in the literature. It is also interesting to note that more people would be concerned about the appearance of the landscape with solar power plants than with wind power plants. This finding was also supported by the in-situ study. This may also be due to the use of a photomontage of a ground-mounted solar farm (see Annex 2) which was used in the questionnaire. This takes up considerably more space than wind farms (in the second illustration).

A comparison of these findings with studies at a higher level (European Social Survey) and lower level (in-situ study) provides further information about the social acceptability of RES and opens some questions about the potential methods of exploring it. In terms of Slovenia's positioning in the European environmental value framework, it can be concluded that Slovenia is at a crossroads between European countries with high levels of acknowledging climate change and the reasons why it is happening and countries with a pattern of weaker acceptance of the climate paradigm and decarbonisation measures in Eastern and Central Europe. This provides further insight into the nature of RES acceptability in Slovenia. In terms of agreeing in principle, Slovenia tends to move towards the group of Western European countries, while it remains more sceptical in some more specific beliefs. With regard to support for renewables and subsidy policy (in the sense of letting the state take responsibility), Slovenia is ahead but it remains behind in environmental empowerment. This is corroborated by the economic benefits of RES being chosen more frequently than environmental ones in the RES study. According to the Climate Change Module (ESS 2016), Slovenians are three times more concerned about the affordability of energy than the security of supply or climate change. This indicates a strong material conditionality in the formation of public attitudes towards energy policy. It should be noted that both surveys were conducted before the onset of the energy crisis in 2022. Regardless, it is clear that if Slovenia shows mainly support in principle and does not show support for practices that also represent a certain material self-limitation, it will end up as an advanced European country that strongly subscribes to environmental values but still generates a high carbon footprint (Fritz & Koch, 2019).

The perceived relationships between stakeholders in decision-making about RES in the RES survey also align with the ESS results. In order to position Slovenia alongside the more developed countries, it would first need to develop more systemic trust. This is one of the most critical levers in facilitating the implementation of climate measures. The RES survey showed high levels of distrust of national politics in making good decisions about RES use. The ESS data also shows low levels of individual feeling where individuals feel they can contribute to solving the climate crisis through personal effort. The most resigned attitude in this respect is particularly evident in countries that are more reluctant to accept climate change although this does not include Slovenia according to the data. However, in the RES survey, respondents believe the most important actors in decision-making in RES developments are experts and local residents, indicating that as climate measures become more specific, they also become easier to envision as actions that individuals or communities could undertake.

While the high level of support at the general and national level is in line with the results of most other similar surveys, the high level of support at the local level is surprising in its own way, Indeed, it is often reports of local opposition to the construction of such facilities which is seen. However, there is also the possibility that the opposition to local projects reflected in the literature (Segreto et al., 2020) often comes from a so-called 'vocal minority', while the majority may still support or at least not oppose such projects. The support shown by the RES survey is undoubtedly supported by the fact that it is based on a representative sample. However, it is worth mentioning that comparing the survey results with the in-situ findings suggests that high acceptance at the local level might also be partly because of the survey context rather than a genuine acceptance of specific projects. This mainly opens up questions about framing such surveys and further strengthens the idea of different kinds of acceptability, as

proposed for example by Wüstenhagen et al. (2007). In this way, it opens up a debate on the possible drawbacks of assessing the acceptability of different solutions using a purely quantitative approach and photographic simulations as surrogates for real landscapes. It is possible that the local context in the survey was still relatively abstract and respondents did not fully identify with the presented location as their own, but as being 'somewhere else'. Any future surveys attempting to measure social acceptance of particular projects should carefully frame the enquiry in a way so as to elicit the place-related values in which a project will be constructed. This would ground the respondent in the specific place rather than just an abstract frame of thinking about renewable energy projects. On the other hand, it is also clear that the insights of an in-situ study cannot be generalised. The research themes presented are highly topical and resonate from all directions. The least that can be noted is that more such comparisons or research monitoring for RES solutions is needed to draw more universal or definitive conclusions. At this point, it is vital to understand the methodological implications of measurement. If the results from the triangulation method are not entirely consistent, this should primarily serve as an incentive to develop survey tools and methods that are both robust and sensitive enough for future studies.

In conclusion, a comparison of the results at three levels shows that effective decarbonisation measures, in this case renewable energy, are by no means unambiguous. These changes require careful consideration, not least in the context of the accompanying economic and social consequences that will undoubtedly arise from implementing new environmental policies and changes in the landscape. These measures will only be successful if they take place in the context of a broader social transformation that is linked to inclusive decision-making and fair distribution of resources and risks. However complex the task, it is certain that any postponement of decisions into the indefinite future will only bring more consequences, the ongoing mitigation of which will remain the dominant form of environmental policy. Such a policy will be, more likely than not, powerless to address the climate crisis in the longer term.

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The authors have no conflict of interest to declare.

The author did not preregister her research plan.

ESS and RES survey (Slovenian Public Opinin) data can be accessed via ESS data portal https://www.europeansocialsurvey.org/data-portal and ADP https://www.adp.fdv.uni-lj.si/. Data sources:

ESS8 - integrated file, edition 2.3; Data file available at: https://ess.sikt.no/en/datafile/ffc43f48-e15a-4a1c-8813-47eda377c355/93?tab=0 (Press download, registration required)

SJM 19/1 data file is accessible at ADP - Social Science Data Archives. Data file available at: https://www.adp.fdv.uni-lj.si/opisi/sjm191/ (for download choose: Data description/ Podatkovna datoteka/ Download; registration required)

CRediT author statement

Author 1: conceptualisation, methodology, resources, writing – original draft, writing – review & editing, visualisation

Author 2: conceptualisation, methodology, formal analysis, data curation, writing – original draft, writing – review & editing

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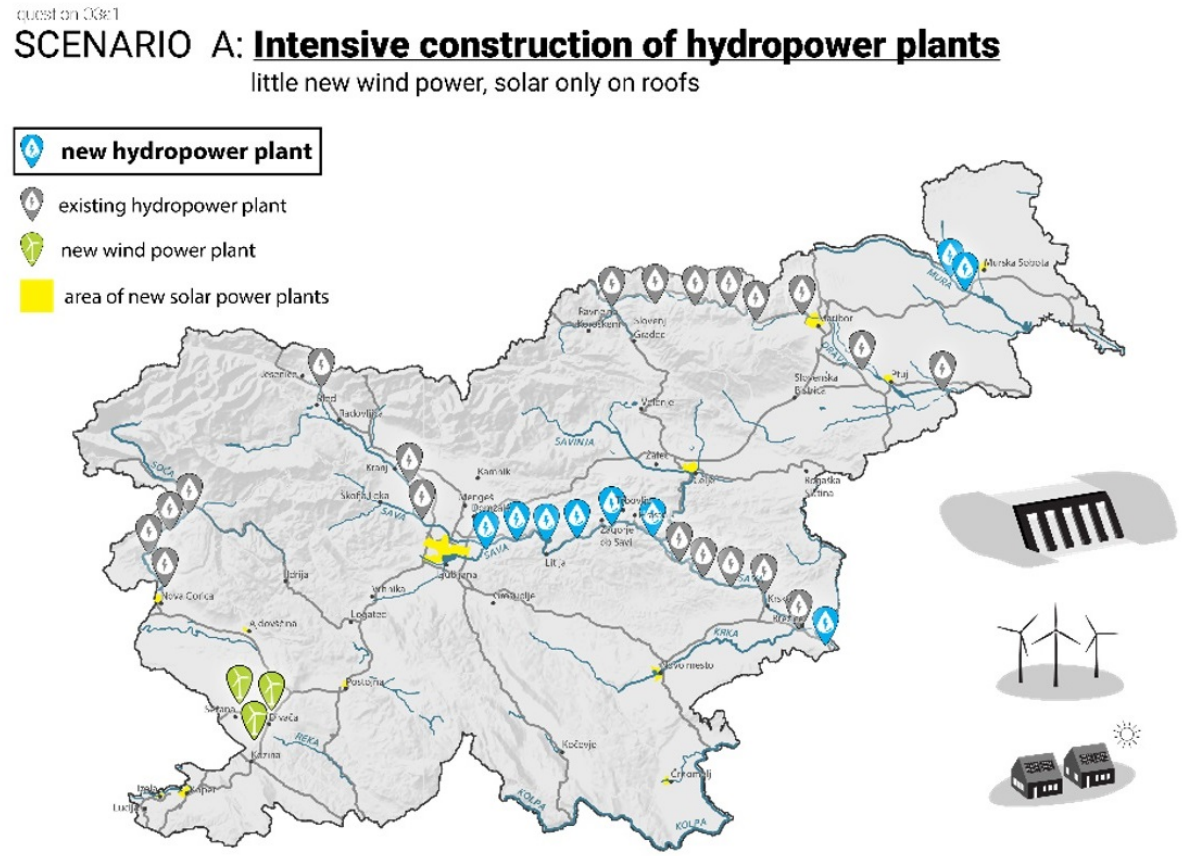
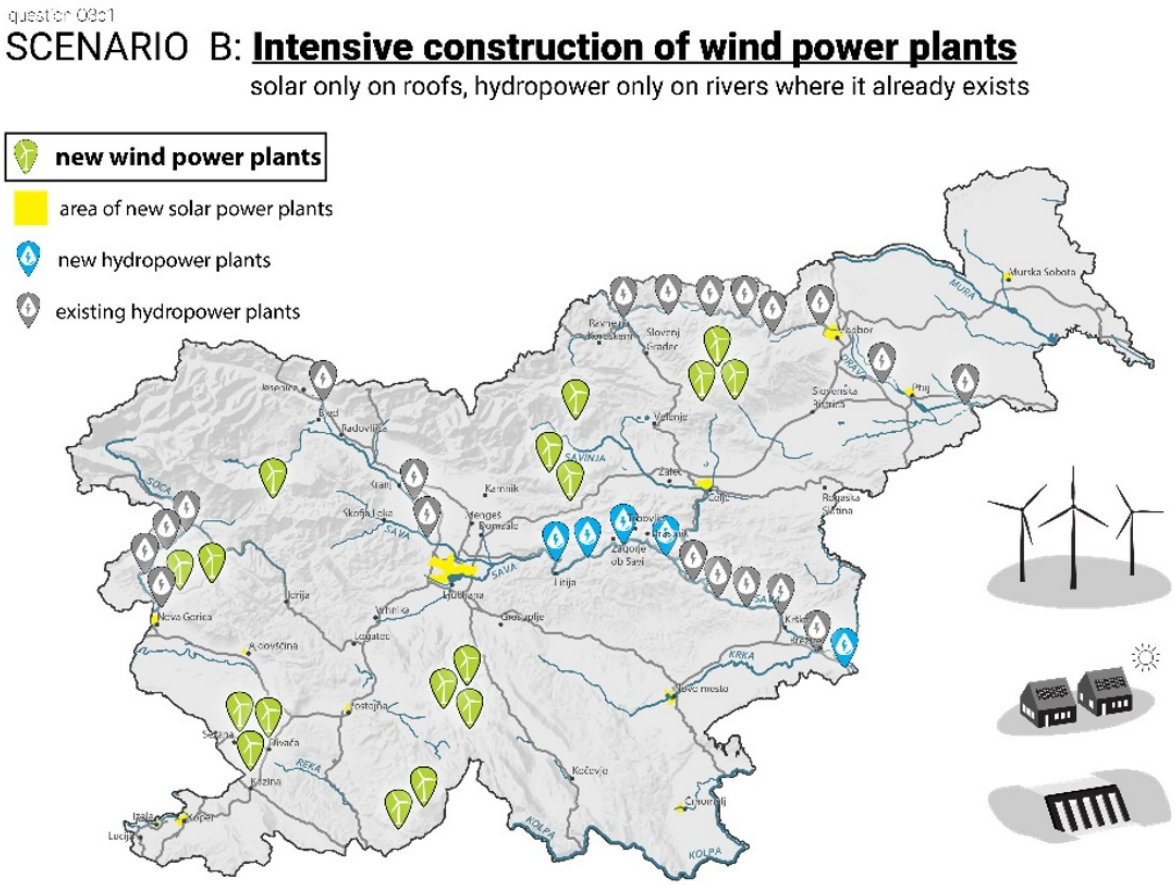
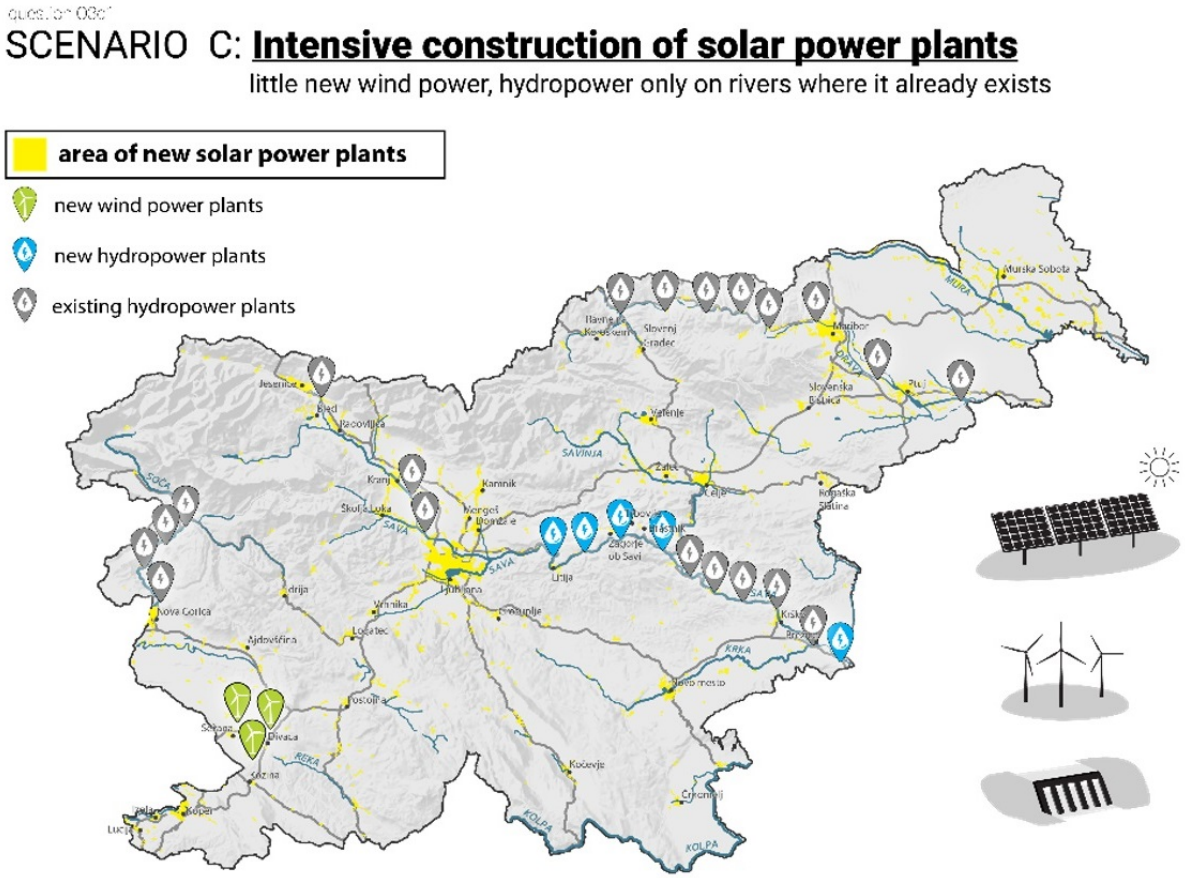
Appendix 1: *Questionnaire graphic annexe on RES scenarios*



Source: author's elaboration



Source: author's elaboration



Source: author's elaboration

Appendix 2: *Questionnaire photo annexe (photomontage)*

Source: Photos and photomontage by Tadej Bevk, 2019

Source: Photos and photomontage by Tadej Bevk, 2019

[1] The Intergovernmental Panel on Climate Change (IPCC). The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science of climate change. Climate Change 2023 Synthesis Report.
[2] In this context, the climate paradigm means the prevailing attitudes, beliefs and understandings about climate change and its impacts on the environment and society. It is a holistic framework of understanding that integrates the scientific, social, political and economic aspects of climate issues that relate to responsibility and the need to reduce greenhouse gas emissions at a global level.

[3] The ESS relies on cross-sectional survey data collection from a representative sample of individuals aged 15 and over across multiple European countries (see Table 1). The ESS sampling design aims to maximise comparable sampling procedures in all participating countries. It follows the strict principles of randomness and probability-based sample selection at each stage. Its methodology has reached the highest level of standardisation in comparative social science research (Malnar & Kurdija, 2010). The survey was conducted in 2016 and 2017 and included more than 44,000 respondents in all participating countries. ESS8 – integrated file is accessible at ESS data portal (see Acknowledgements for link).

[4] A summary of the results is available on the ESS Topline Series "European Attitudes to Climate Change and Energy" at https://www.europeansocialsurvey.org/findings/topline-series.

[5] The Slovenian Public Opinion Survey (SJM) is the original Slovenian empirical research project with the longest data history (since 1968), which gives the survey a high intertemporal comparative value. Its remarkable thematic breadth covers the field of many social science disciplines (Malnar, 2021), with research on environmental issues playing an important role.

[6] SJM 19/1 data file is accessible at ADP - Social Science Data Archives (see Acknowledgements for link).