Ellen Fetzer
editor

Regenerative Landscapes

Designing the Transition

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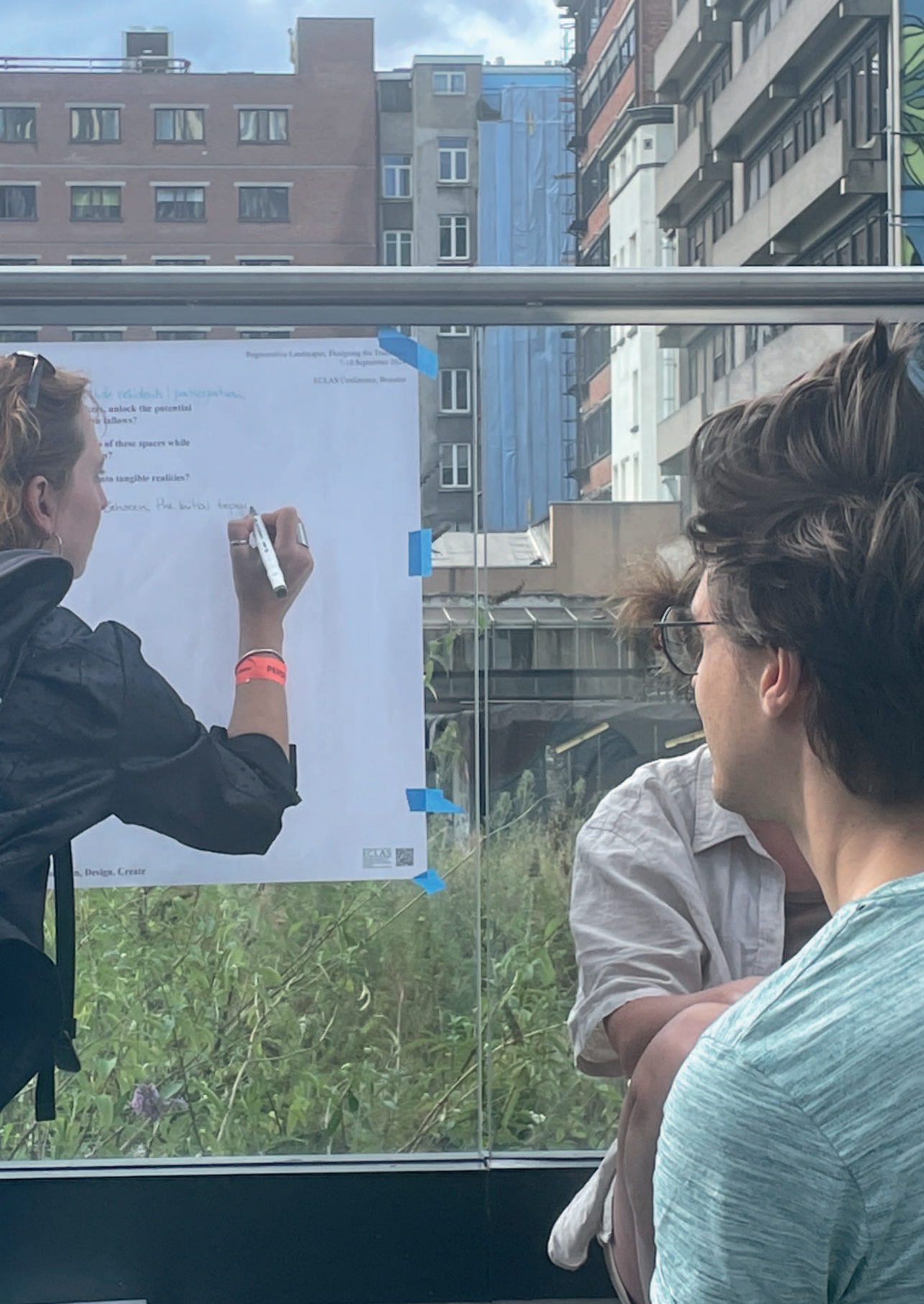
ECLAS Conference, Brussels
unlock the potential
of these spaces while
into tangible realities?
ECLAS

Regenerative Landscapes

Regenerative Landscapes - Designing the Transition

Selected Proceedings of the ECLAS 2024 Conference

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Conference Chair: Didier Vancutsem

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Regenerative Landscapes

Designing the Transition

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Editorial

As President of the European Council of Landscape Architecture Schools (ECLAS) it is my great pleasure to introduce these selected proceedings of the ECLAS Conference 2024, hosted at the Université Libre de Bruxelles (ULB) in Brussels. The conference theme, *Regenerative Landscapes – Designing the Transition*, has underscored the critical role of landscape architecture in navigating the complexities of climate change, biodiversity loss, and societal transformation.

We have gathered with almost 300 people in Brussels at a pivotal moment. Our landscapes -both urban and rural- are under unprecedented pressure, with six of nine planetary boundaries already exceeded. This conference provided an opportunity to reimagine landscapes not merely as spaces of adaptation but as active agents of regeneration. The contributions in this volume reflect a shared commitment to fostering landscapes that restore ecological function, enhance social equity, and inspire cultural renewal.

Our thematic tracks have explored the diverse facets of regeneration: from energy and mobility landscapes to foodscapes, hidden landscapes of the global value chain, biodiversity regeneration and democratic landscape transformation. Each theme represents a vital component of the transition towards resilient, equitable, and thriving landscapes. The discussions initiated here will be crucial in shaping the future of landscape education, research, and practice.

I extend my sincere gratitude to the organising team, our hosts at ULB and CIVA Brussels, and the dedicated researchers, educators, and practitioners contributing to this conference. Further, the conference and these proceedings would not have been possible without the TELOS ERASMUS project and its team. TELOS provided the conceptual framework for designing our call for papers guiding the discourse of this conference.

I hope that our 2024 gathering has served as a catalyst for new collaborations and bold ideas, driving the discipline of landscape architecture toward a regenerative future.

Dr. Ellen Fetzer
ECLAS President 2018-2024
European Council of Landscape Architecture Schools

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Contents

Unlocking the regenerative potential of solar landscapes through multidimensional design and planning

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Keywords: solar power plants, renewable energy transition, landscape-based approach, multidimensional design, guidelines

Abstract

The current implementation of renewable energy technologies has been posing environmental, ecological, social and cultural concerns. Besides climatic, technical and economic considerations, the concept of landscape can be more included to ensure a regenerative energy transition. This study draws on the experience gathered from the PEARLS project, focusing on planning and engaging people in the energy transition in the Mediterranean countries. The framework facilitates the shift from mono-disciplinary perspectives to holistic approaches enhancing relationships between natural systems, energy infrastructures and inhabitants. Based on interviews with experts, literature studies and case studies analysis, the study collects and presents design strategies addressing multiple dimensions of solar landscapes. The outcome is a methodological framework to foster a holistic perspective as spatial planning and design considerations providing a useful tool for decision-makers, planners and designers for multidimensional energy landscapes

Introduction

The use of Renewable Energy Sources (RES) is crucial to achieving the realisation of Europe's climate change mitigation and neutrality objectives. In recent years, many Renewable Energy Infrastructure (REI) projects have been implemented, paving the way for the attainment of the 2020 targets. However, this has also led to questions regarding the implementation of these projects and the potential impacts they may have. The energy transition, in fact, requires a significant transformation of the landscape - of the spaces in which we live and work - causing immediate, unusual and dramatic changes (Selman, 2010). Such transformations have caused various situations of opposition in recent years, as they impact not only the physical space, but also the way in which the user uses and interprets space (Wolsink, 2018). Furthermore, REI, being distributed infrastructure, may cause environmental impacts. The occupation of land with ground-mounted Solar Power Plants (SPPs) conflicts with the use of land for agricultural production and often reduces biodiversity (Scognamiglio et al. 2016, Sánchez-Pantoja et al 2018). Several studies in recent years have addressed the issue of reducing the impacts of REIs, for instance in relation to the topic of visual impact, biodiversity loss or soil erosion (e.g. Oudes and Stremke 2018). Furthermore, a growing focus has developed on social and landscape aspects (Bevk and Golobic, 2020; Salak et al. 2021). These concerns have been translated into practical terms with an accurate selection of areas on which to implement renewable energy projects. In this way, it is possible to exclude fragile and landscape-sensitive areas from the list of eligible areas (Clarke et al. 2020). Nevertheless, this approach serves to mitigate the impacts of energy projects in the environment, rather than providing new value to the areas involved. Adopting a regenerative approach allows for the simultaneous consideration of various aspects, with the aim of producing positive impacts rather than limiting them. In addition to addressing environmental impacts, regenerative design serves as a catalyst for positive change by acknowledging the coexistence of natural and human systems. Thus, landscape transformations simultaneously enhance the value of natural capital and the systems of water, energy, materials and users. In this context, the topic of energy transition becomes one of the challenges addressed in landscape design, which can also take into account, for example, climate change adaptation or public acceptance.

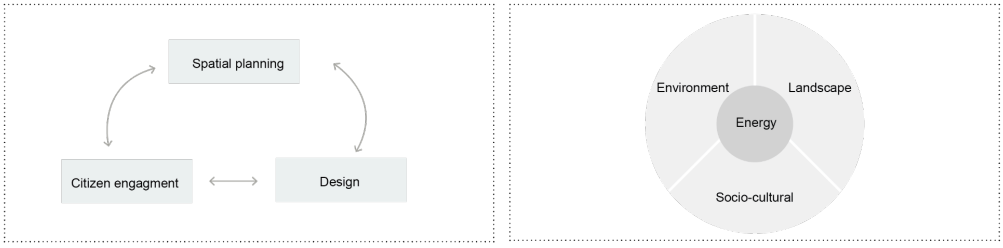
This study presents strategies that can be employed in the implementation of Renewable Energy Landscapes (RELs) with the objective of creating value and increasing acceptance. The results provide useful information that can be used as guidelines for local energy planning practices and to inform projects that enhance landscapes while reaching energy targets. In particular, the findings may contribute to the definition and evaluation of site selection criteria and to the introduction of design strategies that preserve and enhance landscape quality in the study areas.

Framework and methods

This study draws on the research activities conducted within the framework of the European Union's Horizon 2020 Planning and Engagement Arenas for Renewable Energy LandscapeS (PEARLS) project (2017-2023, coordinated by the University of Seville). In particular, PEARLS examined the aspects of spatial planning and the engagement of people in strategic decisions for the energy transition in Mediterranean countries (Barral et al., 2019). The project was based on international, cross-sectoral and multidisciplinary collaboration among research institutions and companies in Spain, Portugal, Italy, Greece and Israel. The research activities were also explored through staff exchanges between research institutions and companies in the aforementioned partner countries. The research conducted, through a variety of experimental methods and from the perspective of different disciplines, confirmed that the consideration of landscape is crucial in the energy transition. Through case studies in Spain, Portugal and Greece and through collaboration with local companies and consultancy agencies, we conducted investigations to ascertain how landscape could be included in local planning tools and design processes, with a particular focus on solar landscapes (e.g. Spyridonidou et al. 2021).

The implementation of solar landscapes has the potential to address a number of interrelated challenges, including those related to energy and food production, biodiversity conservation, and water management. In addition to the production of energy, the implementation of SPPs allows for the consideration of three further dimensions: landscape, environment and socio-economic conditions (Oudes and Stremke, 2022). Indeed, multifunctional SPPs may produce renewable energy while providing agricultural functions (Toledo and Scognamiglio, 2021), enhancing flora and fauna (Randle-Boggis et al 2020) or creating spaces for socialisation (van den Berg and Tempels, 2022). Consequently, they can be investigated not only in terms of energy production but also through a multidisciplinary system thinking approach, which encompasses local dynamics such as climate, ecology, human perspectives, and incorporates concepts of circularity, ecology, human wellbeing, and climate adaptation. The development of multifunctional SPPs affects the selection of suitable areas, which can be less restricted, as the typology of SPPs might also change its physical

Figure 1: Research framework: strategic dimensions explored and involved dimensions of the energy transition. Source: author



aspects. Indeed, spatial configurations and spatial properties are not only influenced by aesthetic considerations but also by the need to accommodate other functions (Blaydes at al. 2024; Buton et al. 2024). This approach necessitates the establishment of a network between various disciplines related to planning and design, as well as the integration of interdisciplinary system thinking.

Literature review, experimentation of new methodologies in collaboration with environmental consultants, and interviews with experts such as university professors, local decision-makers and practitioners were conducted in order to investigate how to implement these concepts into decision-making processes. In particular, our attention was directed towards local spatial planning tools, methodologies for citizen engagement and design strategies. In order to identify elements that could be improved, we engaged in a process of mutual learning and information sharing in a circular manner (Fig. 1). In strategic terms, the proposal encompasses several key aspects. At the planning level, the introduction of varying degrees of 'appropriateness' of land is suggested to guide the implementation of renewable energy facilities, each associated with specific requirements for landscape and environmental integration. Furthermore, community involvement should be incorporated into local planning through co-creative approaches and surveys investigating the perception of citizens regarding REIs. At the design stage, it is essential to consider the territorial, landscape and architectural scales. For instance, at the territorial scale, it is crucial to evaluate the patterns and density of facilities, while at the architectural scale, it is important to consider details such as the colour of facilities. In particular, the design of SPPs must consider how to accommodate other functions (e.g. through the density of the panels) or to address the visibility of the panels (e.g. through access modes, shapes of the panels, and the fence). Furthermore, the design of SPPs should consider the temporality of a plant, for instance in terms of reversibility.

To provide further insight into potential strategies, this contribution presents the advanced research and proposals developed for the case study of Arcos de la Frontera, Spain. In particular, a proposal for a potential local energy planning tool was developed, which could be integrated into local spatial planning tools.

Case study: Arcos de la Frontera, Spain

Spain is an interesting example of implementation of SPPs favoured by geography as well as by the legal conditions. These conditions favoured a strong and rapid expansion not managed by structured territorial planning and creating landscape integration questions (Mérida-Rodríguez et al., 2015). The case study is located in the South of Spain, in the

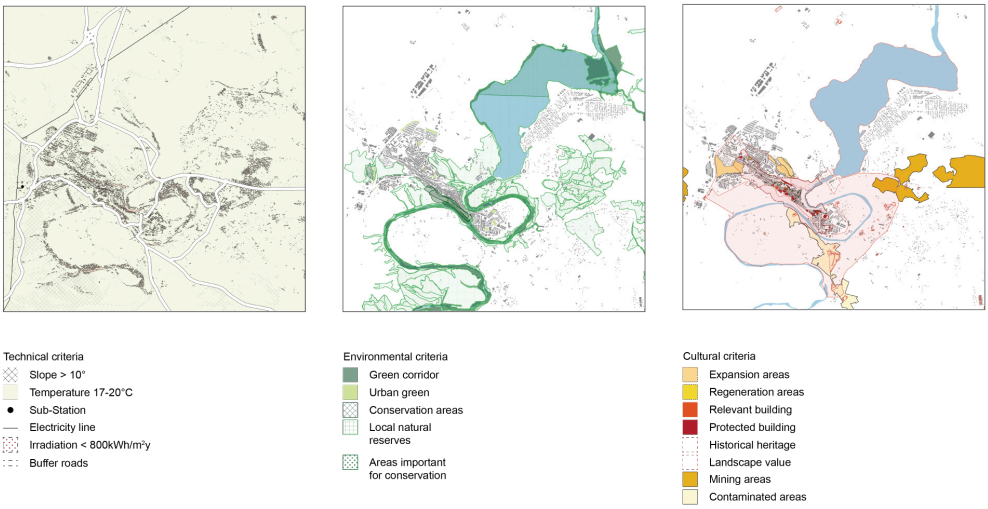
Figure 2: Case study: Arcos de la Frontera. Picture from the valley floor and location in Spain. Source: authors

Municipality of Arcos de la Frontera in Andalusia. Arcos de la Frontera is a small city situated in the inland of the Province of Cádiz, with an area of 526.81 km² and a population of 30,741 (figure 2). The municipality has a distinctive topography: the historic centre and urban area are situated on a sandstone hill, while the peri-urban and agricultural areas are located in the surrounding flat areas, along the Guadalete river and the reservoir. For this case study, we collaborated with a local landscape planning consultant and we interviewed local experts to better understand the context. The aim of the study was to provide guidelines for the implementation of new solar landscapes, considering both ground-mounted and on-buildings SPPs.

The adopted methodology includes literature review and local experts consultation to build the structure of the proposal. To define spatial planning and design strategies, the methodology also included citizens' interviews and collection and creation of georeferenced data. The results include a map of different degrees of suitability for solar landscapes in the municipality, each associated with required landscape design strategies. Further details on the methodology and on the specific results are available in Codemo et al. 2023.

To define degrees of suitable areas, we collected and visualised potentials and constraints for the implementation of SPPs including aspects related to four categories: technical and legal, environment, biodiversity, land use and cultural (figure 3). Technical (e.g. solar radiation) and legal considerations (e.g. distance from streets) were considered restrictive, as they influence efficiency and distance from urban components. The other aspects had different degrees of suitability (i.e. suitable, required mitigation and unsuitable) and were weighted differently based on the consultation with the experts, who were asked to prioritize the importance of the assessment criteria. For example, landscape and heritage areas were considered very sensitive, while the soil agrological value was considered less important. The results of this first part were then further operationalized based on their visibility from urban areas, from walking paths and from viewpoints, and on the sensitivity of the areas (e.g. regeneration areas, heritage areas). This process of spatialization of siting criteria and consultation with experts and citizens to understand the sensitivity of the areas, allowed a discretization of the municipality surface into different degrees of suitability for the implementation of ground-mounted and buildings' photovoltaics. Specifically areas were categorised as not suitable, suitable under

Figure 3: Spatialization of parameters defining suitable areas. Source: authors



conditions, or preferred. General landscape-integration requirements were defined (e.g. soil conditions after use) for suitable areas, and specific landscape integration strategies were suggested to guarantee landscape care and to take into consideration the sensitivity of the area in the areas suitable under conditions. While landscape integration strategies should be evaluated according to their specific context, a structured list of recommendations has been provided to the Municipality (figure 4).

Specifically, solar power plants are investigated across three scales - territorial (linked to site selection and scale of the project), landscape design (related to the arrays patterns, land cover), and architectural design (connected to the system's components and fencing). The aspects of REL addressed by the strategies are multifunctionality (e.g. agrivoltaic, water management), visibility and accessibility in order to address the multiple dimensions entailed with REL and not only aesthetics. Specifically, according to the interviews with the citizens, important factors for the acceptance of new photovoltaic farms were low visual impact, multifunctionality, harmony with the landscape, and mitigated visibility.

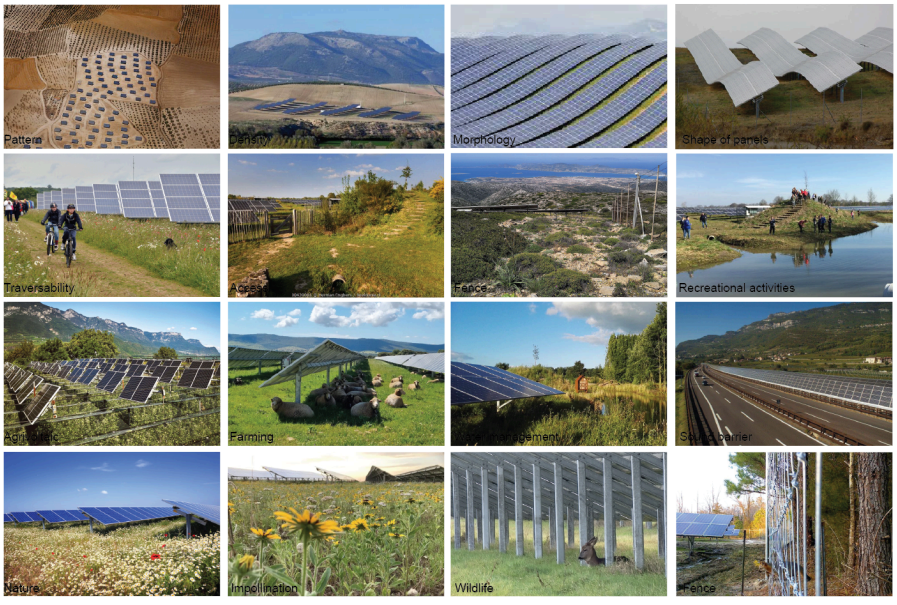


Figure 4: Examples of landscape integration strategies

Conclusion

This study is a result of the staff exchange from the Department of Civil, Environmental and Mechanical Engineering at the University of Trento to Territoria and Claner, two companies in Seville and Malaga. The staff exchange lasted five months and involved the collaboration with the Department of Human Geography at the University of Seville. The collaboration between academia and non-academic partners was useful to better understand local constraints and to propose solutions that could be integrated in the planning tools in force in the study area. Moreover, the interdisciplinary approach was useful for the integration of quantitative and qualitative aspects and to propose a framework that could combine spatial planning with design.

The objective of this study is to provide guidelines that will enhance the value of renewable energy landscapes and facilitate an inclusive and accepted energy transition. The proposed approach is based on an a-priori methodology, which differs from landscape or environmental assessment methods in that it shifts from limiting impacts to providing more value. Indeed, this framework places greater emphasis on the landscape design project of RELs and facilitates a comprehensive evaluation of the projects. Furthermore, it supports the balancing of energy targets with other factors of transformation in the negotiation of landscape values and functions. The outcomes can be useful to environmental planners and designers to negotiate trade-offs, for example, regarding land use and ecological impacts, and to manage transformations, defining both spatialisation and innovative design.

A holistic approach and system thinking are employed in this study. This perspective necessitates the integration of interdisciplinary processes and multiscale approaches, which connect the planning scale with the design scale. The utilisation of multiple scales is beneficial in ensuring the interconnectivity between humans, nature and energy infrastructures, thereby facilitating the implementation of tools. Thus, planning tools may be regarded as flexible instruments, capable of setting specific objectives while allowing for the implementation of different design solutions. The energy transition is shaped by landscape considerations, which necessitate reflection on societal interests, values and concerns.

This reflection must take into account the character of the landscape and the perception of communities. The incorporation of landscape considerations within governmental policies has the potential to alter the projected trajectory of the energy transition. Consequently, it is necessary to coordinate between different governmental levels in order to address and assess the targets. The study was conducted in a specific cultural and landscape context, which limits the ability to generalise the evidence and instead calls for further research in other contexts.

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